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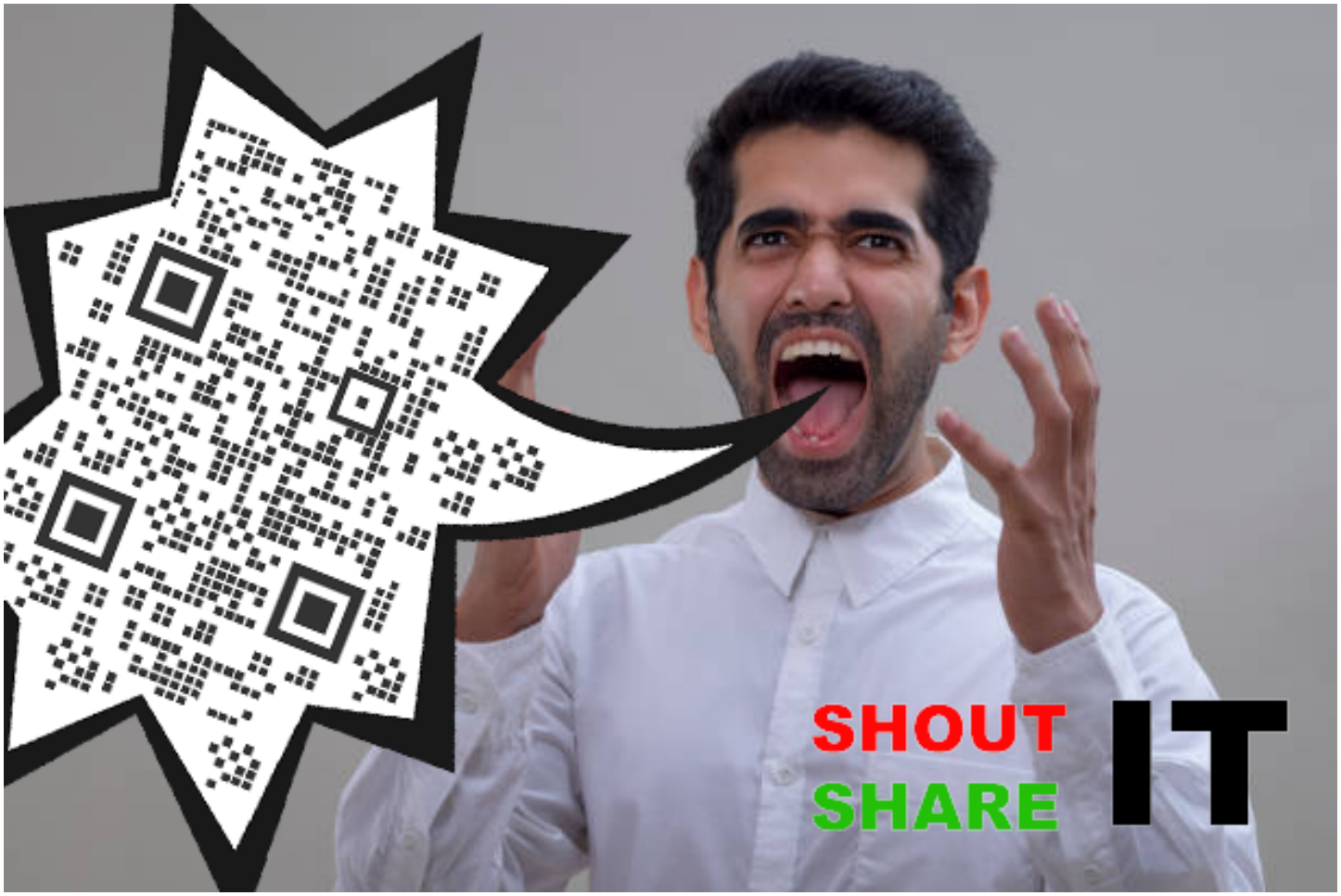
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FROM THE ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1886.

REPORT

OF

THE ORNITHOLOGIST,

C. HART MERRIAM, M. D.

FOR

THE YEAR 1886.

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WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1887.

AUTHOR'S EDITION.

FROM THE ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1886.

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REPORT

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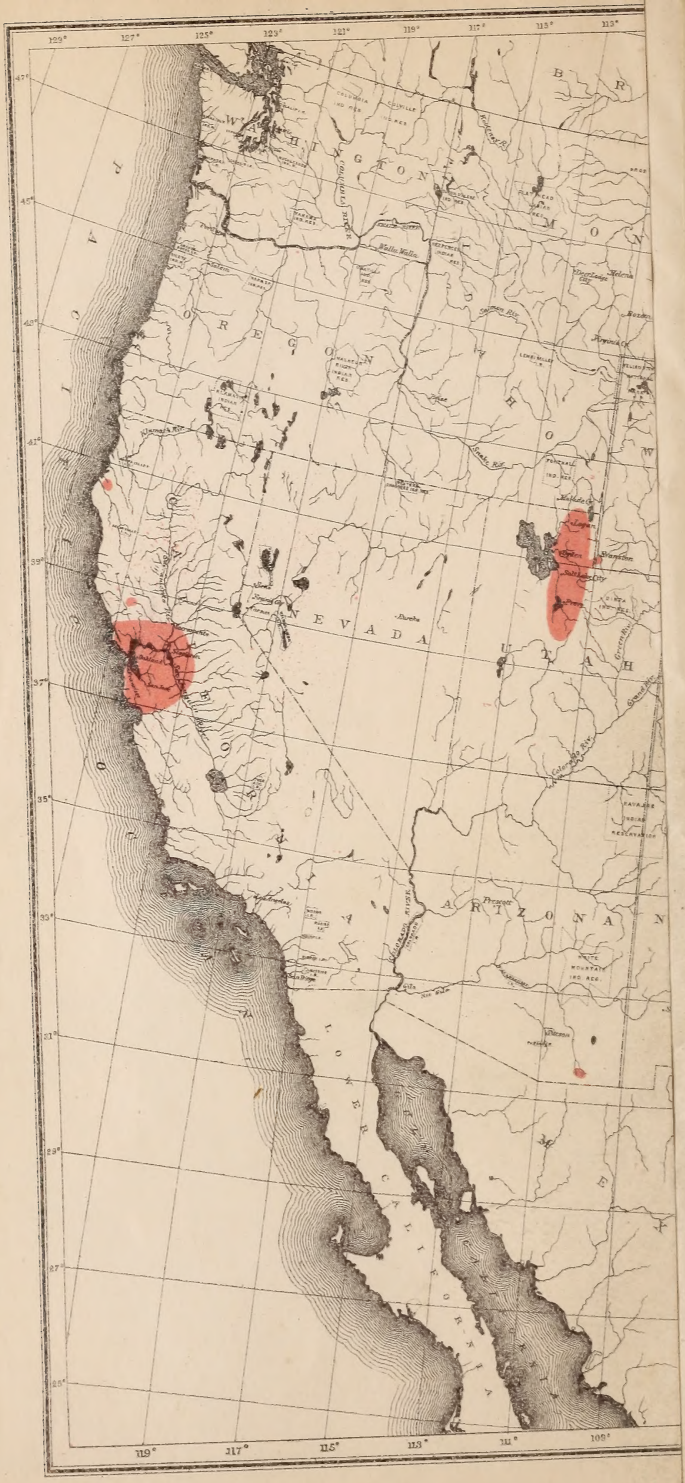
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NEVADA
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WYOMING
COLORADO
NEW MEXICO
Columbia R.
Snake R.
Klamath R.
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Rio Grande
Salt Lake
Great Salt Lake
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Walker Lake
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Carson Sink
Carson R.
Truckee R.
Owens R.
Virgin R.
Gila R.
Pecos R.
Yellowstone L.
Flathead L.
Malheur L.
Goose L.
Tulare L.
Buenaventura R.
Sacramento
San Francisco
Monterey
San Diego
Los Angeles
Santa Barbara
Fort Hall
Fort Boise
Fort Walla Walla
Fort Vancouver
Fort Colville
Fort Hall Indian Reservation
Fort Yuma
Fort Mohave
Fort Defiance
Fort Wingate
Fort Garland
Fort Union
Fort Leavenworth
Fort Kearney
Fort Laramie
Fort Bridger
Fort Crook
Fort Reading
Fort Tejon
Fort Yuma Indian Reservation
Fort Mohave Indian Reservation
Fort Hall Indian Reservation
Walker River Indian Reservation
Pyramid Lake Indian Reservation
Klamath Indian Reservation
Malheur Indian Reservation
Tule River Indian Reservation
Colorado River Indian Reservation
Walker River
Pyramid Lake
Humboldt Lake
Carson City
Virginia City
Austin
Reese River
Ruby Valley
Gold Hill
Silver City
Genoa
Mormon Station
Salt Lake City
Provo
Ogden
Fillmore City
Parowan
Great Basin
Mojave Desert
Colorado Desert
Sierra Nevada
Cascade Range
Rocky Mountains
Wasatch Mountains
Humboldt Mountains
Toyabe Range
Shoshone Mountains
Panamint Range
Coast Range
Blue Mountains
Bitter Root Mountains
Salmon River Mountains
Wind River Mountains
Uinta Mountains
Sierra Madre
Gila Mountains
Organ Mountains
Sandia Mountains
Sangre de Cristo Mountains
Spanish Peaks
Pike's Peak
Long's Peak
Medicine Bow Mountains
Black Hills
Big Horn Mountains
Yellowstone Park
Mount Shasta
Mount Hood
Mount Jefferson
Mount Rainier
Mount Baker
Mount Saint Helens
Mount Adams
Mount Whitney
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Mount Fairweather
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Mount Williamson

120754

REPORT OF ORNITHOLOGIST AND MAMMALOGIST.

SIR: I have the honor to submit the following report of the investigations of the Department in Economic Ornithology from the commencement of the work, July 1, 1885, to the present time.

As you are aware, the Forty-eighth Congress appropriated $5,000 for the promotion of economic ornithology, and made the work a branch of the Division of Entomology. The appropriation became available July 1, 1885, at which time you commissioned me to take charge of the investigations.

A year later, July 1, 1886, pursuant to an act of the Forty-ninth Congress, the work was separated from the Division of Entomology and made an independent division. At the same time its scope was enlarged and its usefulness greatly increased, since the appropriation of $10,000 had been granted "for the promotion of economic ornithology and mammalogy; an investigation of the food-habits, distribution, and migrations of North American birds and mammals in relation to agriculture, horticulture, and forestry."

The work of the division consists in the collection of facts relating to the above subjects, and in the preparation for distribution among farmers and others of special reports and bulletins upon birds and mammals which affect the interests of the farmer, and also upon the migration and distribution of North American species. In this way it is hoped to correct the present widespread ignorance concerning the injurious and beneficial effects of our common birds and mammals, and to put a stop to the wholesale destruction of useful species now going on.

IMPORTANCE OF THE SUBJECT.

The food of all species consists either of animal matter or vegetable matter or both, and its consumption must be serviceable or prejudicial to the interests of mankind. Therefore, according to the food it eats, each bird or mammal may be classed under one of two headings—beneficial or injurious. Many species are both beneficial and injurious, and it is impossible to assign them to either category until the percentages of their food-elements have been positively determined and the sum of the good balanced against the sum of the evil.

It is well known that certain birds and mammals are directly destructive to farm crops, causing a loss of many thousands of dollars each year, and that others are highly beneficial, preying upon mice and insects which are injurious to vegetation; but the extent and significance of these effects and their bearing on practical agriculture is little understood. Morever, great difference of opinion exists, particularly among farmers, as to whether certain well-known species are on the whole beneficial or injurious; and many kinds which are of great practical value are killed whenever opportunity offers. For example, hawks and owls are almost universally regarded as detrimental, while as a matter of fact most of them never touch poultry,

MAP
SHOWING THE DISTRIBUTION
OF THE
ENGLISH SPARROW
(PASSER DOMESTICUS)
at the end of the year 1886.
PREPARED UNDER THE DIRECTION
OF THE ORNITHOLOGIST
by
F. E. L. Beal.
Scale
100 0 100 200 300 400 Miles
BRITISH POSSESSIONS
MONTANA
DAKOTA
WYOMING
NEBRASKA
NEVADA
UTAH
COLORADO
KANSAS
ARIZONA
NEW MEXICO
INDIAN TERRITORY
TEXAS
ARKANSAS
MISSOURI
ILLINOIS
WISCONSIN
MICHIGAN
PENNSYLVANIA
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
PACIFIC OCEAN
ATLANTIC OCEAN
GULF OF MEXICO
LOWER CALIFORNIA
PUBLIC LANDS
INDIAN RESERVATION
Julius Bien & Co Lith

but feed largely, and some almost exclusively, on mice and grasshoppers. Skunks and weasels sometimes prey upon poultry, and for this reason are condemned and destroyed. But, in reality, fully 90 per cent. of their food consists of mice and insects, and their occasional depredations in the poultry yard are unworthy of mention in view of their constant and unremitting services. In fact, I do not hesitate to assert that a single skunk or weasel nets the farmer more in dollars and cents each year than he loses from their depredations during his entire lifetime. And yet so short-sighted is he that he rarely lets slip a chance to kill them; and were these animals more diurnal in habits their race doubtless would be ere now well-nigh exterminated. It may be added that much of the mischief commonly attributed to the weasel and skunk is the work of the mink—the greatest enemy to poultry-farming in this country. It should be mentioned in this connection that the habit of killing poultry is by no means general among the animals that practise it. On the contrary, it is limited to comparatively few individuals, precisely as in the case of the domestic cat and dog. But when once the habit has been formed it is not likely to be abandoned; hence the guilty animal should be killed as soon as possible after the habit is discovered.

THE PENNSYLVANIA "SCALP ACT" OF 1885.

On the 23d of June, 1885, the legislature of Pennsylvania passed an act known as the "scalp act," ostensibly "for the benefit of agriculture," which provides a bounty of 50 cents each on Hawks, Owls, Weasels, and Minks killed within the limits of the State, and a fee of 20 cents to the notary or justice taking the affidavit.

By virtue of this act about $90,000 has been paid in bounties during the year and a half that has elapsed since the law went into effect. This represents the destruction of at least 128,571 of the above-mentioned animals, most of which were Hawks and Owls.

Granting that five thousand chickens are killed annually in Pennsylvania by Hawks and Owls, and that they are worth 25 cents each (a liberal estimate in view of the fact that a large proportion of them are killed when very young), the total loss would be $1,250, and the poultry killed in a year and a half would be worth $1,875. Hence it appears that during the past eighteen months the State of Pennsylvania has expended $90,000 to save its farmers a loss of $1,875. But this estimate by no means represents the actual loss to the farmer and tax-payer of the State. It is within bounds to say that in the course of a year every Hawk and Owl destroys at least one thousand mice, or their equivalent in insects, and that each mouse or its equivalent so destroyed would cause the farmer a loss of 2 cents per annum. Therefore, omitting all reference to the enormous increase in the numbers of these noxious animals when nature's means of holding them in check has been removed, the lowest possible estimate of the value to the farmer of each Hawk, Owl, and Weasel would be $20 a year, or $30 in a year and a half.

Hence, in addition to the $90,000 actually expended by the State in destroying 128,571 of its benefactors, it has incurred a loss to its agricultural interests of at least $3,857,130, or a total loss of $3,947,130 in a year and a half, which is at the rate of $2,631,420 per annum! In other words, the State has thrown away $2,105 for every dollar saved! And even this does not represent fairly the full loss, for the slaughter of such a vast number of predaceous birds and mammals is

almost certain to be followed by a correspondingly enormous increase in the numbers of mice and insects formerly held in check by them, and it will take many years to restore the balance thus blindly destroyed through ignorance of the economic relations of our common birds and mammals.

A knowledge of the food-habits of our common birds and mammals would benefit every intelligent farmer to the extent of many dollars each year, and occasionally would save him the loss of an entire crop. It would save certain States many thousands of dollars which they now throw away in bounties, and would add millions of dollars to the proceeds derived from our agricultural industries.

Hence it becomes the duty of the division to attempt to educate the farming classes in the truths of economic ornithology and mammalogy.

Among the many subjects now demanding the attention of the division are: The depredations of Ricebirds in the South; the status of the so-called English Sparrow in America; the true status of the various birds of prey in relation to agriculture; the depredations of Blackbirds in the grain-growing districts of the Northwest; the destruction of small fruits by birds; the depredations of small mammals, particularly in the West; and the true status of the several species of mammals which prey upon poultry.

PROGRESS OF THE WORK.

Early in July, 1885, a circular was prepared, explaining the objects of the inquiry and asking for information in reply to a number of questions concerning the food-habits of several of our well-known birds. At the same time a collection of the crops, gizzards, and stomachs of birds was begun, for it was clear that in a comprehensive investigation of this kind the study of a bird's habits in the field must be supplemented by a critical examination of its stomach-contents in the laboratory. In this undertaking the Department has been aided by ornithologists throughout the country, many of whom have made large and valuable contributions, thus doubly utilizing birds killed for strictly scientific purposes.

In collecting the facts necessary to a clear conception of the practical side of the question a very large amount of information of great scientific value is incidentally brought together. The migration observers of the American Ornithologists' Union have accumulated a vast quantity of original material, the use of which has been freely accorded the division of economic ornithology. Moreover, a large proportion of the same observers continue to collect data and make reports, which, through the courtesy of the Union, are now sent direct to the Department. But the study of migration and distribution has been subordinated to the study of the more practical phases of the inquiry, for it is the bearing of these investigations upon the avocations of the farmer and fruit-grower that chiefly concerns the Department of Agriculture.

Therefore, in order to obtain a large array of facts, and in some cases the opinions of persons interested as well, I prepared the following circulars, which, with the exception of the one addressed to rice-growers, were sent to the secretaries of the various agricultural and horticultural societies throughout the country, to the agricultural press, and to a large number of farmers and ornithologists. The circular to rice-growers was sent to the addresses of as many rice-plant-

ers as the Department was able to secure, and to the editors of newspapers published in the rice-growing districts.

Following are copies of the circulars issued by the Division of Economic Ornithology and Mammalogy in July, 1886:

[Circular No. 1.]

CIRCULAR ON THE FOOD-HABITS OF BIRDS.

It is well known that certain birds are directly destructive to farm crops, causing a loss of many thousands of dollars each year, and that others are highly beneficial, preying upon mice and insects which are injurious to vegetation; but the extent and significance of these effects, and their bearing on practical agriculture, is little understood. Moreover, great difference of opinion exists, particularly among farmers, as to whether certain well-known species are, on the whole, beneficial or injurious; and many kinds which are really of great practical value are killed whenever opportunity offers. For example, hawks and owls are almost universally regarded as detrimental, while as a matter of fact most of them never touch poultry, but feed largely, and some almost exclusively, on mice and grasshoppers.

The wholesale slaughter of small birds has been known to be followed by serious increase of noxious insects; and invasions of insects which threatened to devastate large tracts of country have been cut nearly short by the timely services of some of our native birds.

In view of the above facts, and many others which might be cited, it is clear that a comprehensive, systematic investigation of the interrelation of birds and agriculture will prove of enormous value to farmers and horticulturists. Such an investigation has been undertaken by the newly established Division of Economic Ornithology of the Department of Agriculture, and the assistance and co-operation of persons interested are earnestly solicited.

The food of all birds consists either of animal matter or vegetable matter, or both, and its consumption must be serviceable or prejudicial to the interests of mankind. Therefore, according to the food they eat, all birds may be classed under one of two headings—beneficial or injurious. Many species are both beneficial and injurious, and it is impossible to assign them to either category until the percentages of their food-elements have been positively determined and the sum of the good balanced against the sum of the evil.

In a very large proportion of our small birds the food varies considerably with the season, sometimes changing from vegetable to animal, or from injurious to beneficial. Furthermore, many birds feed their young upon substances which the adults rarely or never eat; and the young on leaving the nest sometimes greedily devour things which are discarded as they grow older. Hence it becomes necessary to ascertain the food of each species at different times of the year and at different ages.

Information is desired on all questions relating to this inquiry, and special attention is invited to the following:

1. Has the common Crow been observed to catch young chickens or to steal eggs?
2. Has it been observed to eat corn or other cereals in the field? If so, how long after planting, and how extensive was the injury done?
3. Has the Crow been observed to feed upon injurious insects? If so, what kinds of insects were thus destroyed, and to what extent?
4. Has the Crow-Blackbird or Grakle been observed to carry off the young of the Robin or of other small birds, or to destroy their eggs?
5. When breeding near the house, has it been observed to drive off small birds, such as Robins, Bluebirds, &c., which had previously made their abode on the premises?
6. Has it been observed to eat corn or other cereals in the field? If so, how long after planting, and how extensive was the injury done?
7. Has the Crow-Blackbird been observed to feed upon injurious insects? If so, what kinds of insects were thus destroyed, and to what extent?
8. What birds have been observed to feed upon or otherwise injure buds or foliage, and what plants or trees have been so injured?
9. What birds have been observed to feed extensively upon fruit? What kind or kinds of fruit have been most injured by each species, and how extensive have been the losses thus occasioned?
10. The Bobolink (Rice-bird or May-bird of the Southern States) congregates in vast flocks during its migrations and commits extensive depredations in certain parts of the South. The division will be glad to receive detailed accounts of these

depredations from persons living in the affected districts, to whom a special circular will be sent on application.

11. What birds are considered to be injurious to grain crops, and what kinds are regarded as beneficial? On what facts are these opinions based?

12. What birds have been observed to feed upon injurious insects, and upon what kind or kinds does each bird feed?

13. Do Blackbirds (other than the Crow-blackbird already mentioned) commit serious depredations in your vicinity? If so, which of the several species of Blackbirds are concerned, and what crops are affected?

14. Has any kind of bird been observed to feed upon the honey-bee? If so, what species, and how extensive has been the injury done?

When possible, the exact date should be given of all occurrences reported.

Persons willing to aid in the collection of birds' stomachs will be furnished with the necessary blanks and instructions.

Special circulars on the English Sparrow and on the economic relations of mammals will be furnished on application.

[Circular No. 2.]

CIRCULAR ON THE ENGLISH SPARROW.

(*Passer domesticus.*)

The Department of Agriculture desires facts, from personal observation, in answer to the following questions concerning the European House Sparrow, commonly called "English Sparrow" in this country.

I. Is your locality city, suburb, or country?

II. Is the English Sparrow present in your vicinity? If not, what is the nearest point at which you know it to occur? If present, when did it first appear?

III. Is it abundant and on the increase?

IV. Is it protected by law?

V. Is it artificially housed and fed?

VI. How many broods and young does a single pair rear in a season?

VII. Do any of our non-predatory birds habitually resist encroachments of, or attempt to drive off, the English Sparrow unless themselves first attacked, and with what success?

VIII. Which of our native birds attempt to reclaim former nesting sites when these are occupied by the Sparrows? State examples.

IX. Has the English Sparrow been observed to molest or drive off any of our native birds? If so, what species are so molested or expelled from their former haunts?

X. Does it injure shade, fruit, or ornamental trees or vines?

XI. Does it injure garden fruits and vegetables?

XII. Does it injure grain crops?

XIII. Has any case in which it has been of marked benefit to the farmer or horticulturist come under your notice? If so, in what way has the benefit been derived?

XIV. Under what circumstances does it feed upon insects? What kinds of injurious or beneficial insects or their larvæ does it destroy, and to what extent?

XV. What means, if any, have been taken to restrict the increase of the English Sparrow?

XVI. What is the prevailing public sentiment in respect to the bird?

Information is particularly desired concerning the presence of the English Sparrow in the Southern States and in the region west of the Mississippi.

[Circular No. 3.]

CIRCULAR ON THE ECONOMIC RELATIONS OF MAMMALS.

The Department of Agriculture desires information concerning the effects of mammals upon agriculture, and solicits replies to the following questions:

To stock-raisers on the frontier.

1. Have you personal knowledge of one or more cases in which cattle, horses, sheep, or pigs have been killed or injured by Bears, Wolves, or Panthers (known in the West as Mountain Lions)? If so, give full particulars.

To poultry fanciers.

2. Have you personal knowledge of the loss of turkeys, geese, ducks, chickens, or doves from the attacks of predatory mammals? If so, how many and what kinds were killed on each occasion? In each case mention the animal by which you suppose the mischief was done, and your reasons for this belief.

3. What mammals, if any, steal feed put out for poultry?

To farmers, fruit-growers, and gardeners.

4. What mammals, if any, are injurious to grain crops in your neighborhood? In each case state whether the injury is occasioned directly by the consumption or the trampling of the grain, or by tunnels underneath the surface. Is the loss thus occasioned of trifling or serious consequence?

5. What mammals, if any, are injurious to fruit, and what kind or kinds of fruit are eaten by each species? Is the loss thus occasioned of trifling or serious consequence?

6. What mammals, if any, are injurious to vegetables, and what kind or kinds of vegetables are eaten by each species? Is the loss thus occasioned of trifling or serious consequence?

7. What mammals, if any, are injurious to meadows and pastures? In what manner are the injuries committed? Is the loss thus occasioned of trifling or serious consequence?

8. Are your fields subject to periodical invasions of Meadow Mice (*Arvicolæ*)? If so, can you give the exact dates of one or more of such invasions?

9. What mammals, if any, are injurious to forest, shade, fruit, or ornamental trees or shrubs? What kind or kinds of trees or shrubs are injured by each, and in what manner, and at what season is the damage done? Is the loss thus occasioned of trifling or serious consequence?

10. Have you personal knowledge of an instance in which cattle or horses have been injured by stepping into the burrows of Woodchucks, Muskrats, or Badgers? If so, give particulars.

11. What mammals, if any, are beneficial to the farmer? In what manner are these benefits derived?

To rice-growers.

12. Are rats troublesome on your plantation? If so, are they injurious by feeding directly upon the newly-planted rice, or by burrowing in the dikes, or both? Can you estimate the annual pecuniary loss thus occasioned?

13. Do any other small mammals affect the interests of the rice-grower? If so, what kind or kinds, and to what extent?

To hop-growers.

14. What mammals, if any, affect the interests of the hop-grower? In what manner and to what extent are these effects manifested?

Miscellaneous.

15. Is the common mouse about dwellings, barns, and out-buildings in your neighborhood the White-footed or the House Mouse, or are both present? In the latter case, which is most abundant? If uncertain as to the species, please send a specimen (the head will suffice) to the Department for identification.

16. What mammals, if any, injure or deface buildings, household goods, books, or papers?

17. What mammals, if any, injure canals or other embankments, dams, dikes, or drains? Is the damage thus occasioned of serious or trifling consequence?

18. In your opinion, are Moles beneficial or injurious? On what facts is this opinion based?

NOTE.—Meadow Mice, or "Voles," must not be confounded with Moles.

19. In your opinion, are Skunks beneficial or injurious? On what facts is this opinion based?

20. Do you know of one or more instances in which the increase of a species of economic importance has been limited by the abundance of its natural enemies? If so, give particulars.

In the Mississippi Valley, and the region between it and the Pacific, numerous small rodents called Gophers do great damage to farms and crops. There are two principal kinds, Pocket Gophers, which live mostly under ground, and are characterized by external cheek-pouches and unusually large fore-claws (*Geomys* and *Thomomys*), and Gophers or Ground Squirrels, which live mostly above ground, and have neither external cheek-pouches nor claws of unusual size (*Spermophilus* and *Tamias*). Of these the common little Striped Gopher (*Spermophilus tridecemlineatus*) and the large gray "Line-tailed" Spermophile (*Spermophilus grammurus*) and its varieties are most abundant and widely distributed, and occasion the greatest losses to grain crops. Numerous other species, more or less local, affect the farmer's interests very appreciably.

Detailed information is desired concerning the habits and ravages of all these Gophers. Such information should be accompanied by a specimen (a rough skin will suffice) for positive identification.

The above remarks apply with equal force to the various small mammals known as Kangaroo Rats and Mice, Pocket Rats and Mice, Wood Rats and Mice, &c.

In answering this circular please mention your occupation. If a farmer, state the size and character of your farm, and mention the principal crops which you cultivate.

Write your name and post-office address as plainly as possible.

[Circular No. 4.]

INSTRUCTIONS FOR THE COLLECTION OF STOMACHS.

In investigating the economic relations of birds and mammals it is necessary to determine with accuracy the character of the food upon which the various kinds subsist. This is particularly important in the case of species which are known to exert an influence, beneficial or otherwise, upon certain farm and garden crops. Hence the Department of Agriculture desires to secure a collection of the stomachs and gizzards of our native mammals and birds, particularly of those which are supposed to affect agricultural interests.

Method of preparation.

All specimens should be preserved in 90 per cent. alcohol.

A stout paper tag should be attached to each stomach or gizzard by means of a strong thread or fine wire, which should be passed directly through its substance. Each tag should be numbered (in hard pencil) to correspond with the number given the specimen on the accompanying blank. Some birds, particularly in the breeding season, carry food in the gullet or crop. In such cases these portions of the alimentary tract should be preserved, and should bear the same number that is given the gizzard of the same individual.

Stomachs of the following species are especially desired:

Birds.—Hawks, Owls, Crows, Jays, Blackbirds, Cowbird, Shrikes, Cuckoos, Carolina Dove, Woodpeckers, Quail, English Sparrow, Bobolink or Rice-bird, Kingbird or Bee Martin.

Mammals.—Fox, Skunk, Mink, Weasels, Badger, Raccoon, Opossum, Squirrels, Ground Squirrels, Gophers, Mice, Moles, Shrews, Bats.

In the case of Mice, Moles, Shrews, and Bats, the entire animal should be sent, in order that the species may be fully identified.

A number of specimens may be preserved in a single wide-mouthed bottle or jar.

Persons willing to aid in the collection of stomachs will be furnished with blanks on which to record the necessary data.

Transportation charges will be paid by the Department.

[Circular No. 5.]

CIRCULAR TO RICE-GROWERS.

The Department of Agriculture desires the co-operation of rice-growers in its attempt to secure trustworthy information concerning the extent of the injury annually done the rice crop by certain birds, chiefly the Bobolink or Rice-bird and the Red-winged Blackbird: and in devising some measure or measures, consistent with reasonable economy, for the diminution, if not the prevention, of this loss.

Information in reply to the following questions is solicited:

1. Are you a rice-planter?
2. If so, how many acres have you under cultivation?
3. What is the average yield of rice per acre?
4. What do you consider a fair estimate of the average annual loss per acre occasioned by birds?
5. Please cite a few extreme cases.
6. What percentage of this loss is due directly to the value of the rice consumed, and what indirectly to the cost of gathering and thrashing the worthless grain?
7. What is the average annual cost per acre of measures employed for the prevention or diminution of this loss?
8. In addition to the use of fire-arms and whips, what measures, if any, are employed for this purpose?
9. How many "bird-minders" are employed annually upon your plantation during the fall invasion of Rice-birds?
10. How many pounds of gunpowder are consumed annually during this period?
11. Is shot now used on your plantation? If so, in what quantity?
12. What kind or kinds of birds are most destructive to rice?
13. At what time of the year and for how long a period are these birds present?
14. What is the greatest number of Rice-birds that you have known to be killed in a single season?
15. Does the rice crop on your plantation sustain a loss from the depredations of birds at time of planting in spring? If so, what is the average loss per acre at this time?

Any information relating to the subject, though not covered by the above questions, will be thankfully received.

In some cases the above circulars were accompanied by schedules. The number of each distributed will appear in the following statement:

CIRCULARS AND SCHEDULES DISTRIBUTED.

Circulars:		
On the food-habits of birds	4,000	
On the English Sparrow	4,000	
On the economic relations of mammals	2,500	
On the collection of birds' stomachs	600	
To rice-growers	600	
		11,700
Schedules:		
On the English Sparrow	5,000	
On migration	1,500	
Stomach blanks	500	
		7,000
Total of circulars and schedules distributed from July 1 to December 10, 1886		18,700

This number does not include circular letters, of which 2,345 have been sent out: making 21,045 in all.

The correspondence of the division is so large that it is very burdensome. More than four thousand letters were acknowledged during the six months ending December 31, 1886.

At the outset it was seen that two birds pre-eminently claimed the immediate attention of the division, namely, the so-called English Sparrow (*Passer domesticus*), and the Bobolink or Rice-bird (*Dolichonyx oryzivorus*). These birds, by their numerical abundance, the extent of the damages they were said to cause at certain times of the

year, and the widespread difference of opinion in regard to their economic status as a whole, demanded searching and systematic investigation; hence they have been made subjects of special research.

Cock Sparrow. (From Yarrell.)

The English Sparrow (*Passer domesticus*).*

Questions relating to the English Sparrow were contained in the first circular on economic ornithology issued by the Department (in July, 1885). Subsequently these questions were amplified, and during the current year a special circular and schedule were prepared, upwards of five thousand copies of which have been distributed. To date, replies have been received from about thirty-two hundred persons. They contain a vast amount of valuable information, which is now being collated for publication. In order to be able in future years to determine the rate of spread of the Sparrow over regions which it does not now occupy, the Department has ascertained, with as much precision as possible, the exact limits of its distribution at the present time, and has shown the same by means of the accompanying colored map. In addition to the material collected by the Department of Agriculture, the American Ornithologists' Union has turned over to the division the results of its investigations, begun in 1883, on the eligibility or ineligibility of the European House Sparrow in America. The material has been since collated and arranged by Dr. F. H. Hoadley, who, from interest in the subject, kindly volunteered his services.

In advance of the publication of the special bulletin on the English Sparrow question, which will contain in detail the evidence on which the following statements are based, it is thought desirable at the

*The true name of this bird is the "House Sparrow." The name "English Sparrow" is a misnomer, as the species is not confined to England, but is native to nearly the whole of Europe. The fact that most of the birds brought to America came from England explains the origin of the misleading name by which it is now so widely and universally known that any attempt to change it would be futile.

present time to set forth some of the results of the investigation for the information of the general public, and to make certain recommendations to the legislative bodies of the various States, in order that they may enact, at as early a date as possible, such laws as are demanded for the protection of their agricultural industries.

Introduction of the English Sparrow.

The English Sparrow was first brought to this country, so far as authentic information has reached the Department, in the fall of 1850, when the Hon. Nicolas Pike and other directors of the Brooklyn Institute imported eight pairs into Brooklyn, N. Y. They were artificially housed over winter and liberated early in the following year; but they did not thrive. In 1852 a larger colony was imported. These birds are said to have multiplied and spread over Long Island and adjacent parts of New York and New Jersey. In 1858, and at subsequent dates, independent importations were made, and colonies were planted in Portland, Me.; Peacedale, R. I.; New York, Philadelphia, and other Eastern cities. In most cases the birds did well. They multiplied and spread gradually to neighboring towns. But the process of diffusion was slow at first, and it was not until 1870 that the species can be said to have firmly established itself throughout the Eastern States, and to have begun in earnest its westward march. From this time to the present, the marvelous rapidity of its multiplication, the surpassing swiftness of its extension, and the prodigious size of the area it has overspread are without parallel in the history of any bird. Like a noxious weed transplanted to a fertile soil, it has taken root and disseminated itself over half a continent before the significance of its presence has come to be understood. The explanation of this phenomenal invasion must be found in part in the peculiar impetus usually given prolific species when carried to a new country where the conditions for existence are in every way favorable; and in part in its exceptional adaptability to a diversity of physical and climatic conditions. This adaptability has enabled it not only to endure alike the tropical heat of Australia and the frigid winter of Canada, but to thrive and become a burdensome pest in both of these widely separated lands.

The English Sparrow is a hardy, prolific, and aggressive bird, possessed of much intelligence and more than ordinary cunning. It is domestic and gregarious in habit, and takes advantage of the protection afforded by proximity to man, thus escaping nearly all of the enemies which check the abundance of our native birds. Moreover, for many years it was looked upon with favor, and both food and shelter were provided it.

Rate of increase of the Sparrow.

Its fecundity is amazing. In the latitude of New York and southward it hatches, as a rule, five or six broods in a season, with from four to six young in a brood. Assuming the average annual product of a pair to be twenty-four young, of which half are females and half males, and assuming further, for the sake of computation, that all live, together with their offspring, it will be seen that in ten years the progeny of a single pair would be 275,716,983,698. This will appear in detail from the following:

Table showing the annual increase and the total number of English Sparrows, the progeny of a single pair, in successive seasons for ten years, assuming that all lived.

Years.	Number of pairs breeding.	Number of pairs of young.	Total number of pairs.	Total number of birds.
First	1	12	13	26
Second	13	156	169	338
Third	169	2,028	2,197	4,394
Fourth	2,197	26,364	28,561	57,122
Fifth	28,561	342,732	371,293	742,586
Sixth	371,293	4,455,516	4,826,809	9,653,618
Seventh	4,826,809	57,921,708	62,748,517	125,497,034
Eighth	62,748,517	754,982,204	815,730,721	1,631,461,442
Ninth	815,730,721	9,788,768,652	10,604,499,373	21,208,998,746
Tenth	10,604,499,373	127,253,992,476	137,858,491,849	275,716,983,698

Method of diffusion of the Sparrow.

"As the towns and villages become filled to repletion the overflow moves off into the country, and the Sparrow's range is thus gradually extended. Occasionally, however, it is suddenly transported to considerable distances by going to roost in empty box-cars and traveling hundreds of miles. When let out again it is quite as much at home as in its native town. In this way it reached St. John, New Brunswick, in 1883, on board the railroad trains from the west. In like manner another colony arrived March 1, 1884, in grain cars from Montreal. Similarly it appeared at Moncton, Fredericton, and Saint Stephen, in Canada, and in a number of towns in the United States." (Hoadley MS.)

Aside from this accidental means of wide dispersion, small colonies have been purposely carried from time to time to various localities beyond the limit of its regular advance, and these in turn have become centers of diffusion. Prominent examples of this sort may be seen in the large colonies now inhabiting California, the basin of the Great Salt Lake, and the region bordering the Lower Mississippi, in Louisiana.

The method by which the Sparrows spread without the aid of man is peculiar. They first invade the larger cities, then the smaller cities and towns, then the villages and hamlets, and finally the populous farming districts.

Rate of spread of the Sparrow, and extent of area occupied at the close of the year 1886.

In the year 1886 the English Sparrow was found to have established itself in thirty-five States and five Territories. Of these it occupies the whole or large parts of the following thirty-three States and two Territories: Alabama, Arkansas, California, Connecticut, Delaware, District of Columbia, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Utah, Vermont, Virginia, West Virginia, and Wisconsin, and is found in a few towns in Florida, Texas, Wyoming, Idaho, and Arizona. Small, isolated colonies may exist in a few other Territories, but if so they have escaped the searching inquiry of the Department. In the United States the total area occupied at the close of the year 1886 is 885,000 square miles; in Canada it is not quite 148,000 square miles; in all, 1,033,000 square miles.*

*The data on which the computation of the Canadian area is based are insufficient, consequently the size of the area here given must be regarded as approximate only. The United States area, however, may be looked upon as very nearly exact.

Some idea of the alarming rapidity with which it is at the present moment multiplying and extending its range may be had from the fact that in the United States alone it has spread during the past fifteen years at the average rate of 59,000 square miles per year, and in the United States and Canada together at the rate of 69,000 square miles per year. But this *average* rate manifestly is misleading, so far as both extremes are concerned, for species increase in geometrical ratio. The rate for some time after 1870 was comparatively slow, while during the present decade it has progressed with astonishing rapidity, till in the year 1886 the new territory invaded must have reached the enormous number of 516,500 square miles, as may be seen from the following:

Table showing approximately the extension in square miles of the English Sparrow, in periods of five years each, from 1870 *till* 1885, *and its extension during the year* 1886.*

	Square miles.
From 1870 to 1875 it spread over	500
From 1875 to 1880 it spread over	15,640
From 1880 to 1885 it spread over	500,760
In the year 1886 it spread over	516,500

The Sparrow an enemy of our native birds.

Of all the native birds which habitually make their homes near the abodes of man, the Martin is the only species which is able to hold its own against the Sparrows, and numerous instances are on record where even the Martin has been beaten and forced to abandon its former nesting-places by these belligerent aliens. It sometimes happens that the Martin is killed outright, as appears from the following account, just received from Prof. F. H. King, of River Falls, Wis.:

Mr. H. T. Baker, of Berlin, Wis., has related to me that last summer he was a witness of a conflict between some English Sparrows and Purple Martins, in which the Sparrows were trying to get possession of breeding-places which had been occupied for several years by the Martins. The Sparrows had congregated in a large flock upon a tree standing near a building, in the cornice under the eaves of which the Martins had their nests. From this point a number of Sparrows would together attack the Martins, and then return to the tree, to be followed by a similar squad. This method of attack was followed until three Martins had been killed, some of the Martins having had their eyes picked out. It need hardly be added that the Martins were forced to leave. The same gentleman tells me that he saw the Sparrows kill in the same manner a bird, the name of which he did not know, in the city of Milwaukee.

The birds which have suffered most from the English Sparrow, and whose cheery presence in the parks and lawns in the nesting season we no longer, or only rarely, enjoy are the Robin, Catbird, Bluebird, Wren, Song Sparrow, Chipping Sparrow, Yellow-bird, Oriole, Vireo, and Phœbe. Not only does the Sparrow drive away and sometimes kill the adult birds, but when it finds their nests it throws out the eggs and young, and not infrequently feasts upon them. Dr. B. Harry Warren, State ornithologist of Pennsylvania, writes:

Our native birds have rapidly and steadily diminished in numbers since the Sparrows came. Former plentiful residents are rare. Even transient visitants and migrants have been so pursued by the usurper that they now seem to avoid West Chester as a plague-stricken spot. In 1877 I saw two Cock Sparrows attack a nest

*This table of necessity is largely theoretical, though the ratio of increase must be very nearly correct. Year by year much of the reproductive energy of the Sparrow is expended in filling up the smaller towns and villages of the area which, so far as the larger towns and cities are concerned, it covered some time previously.

of the Warbling Vireo in the absence of the parent birds, pull out one at a time the four half-fledged occupants, and drop them on the ground. After partly destroying the nest the Sparrows alighted on the ground beside their victims, and, being reenforced by several of their kin, proceeded to enjoy the sanguinary repast.

Numerous parallel cases have been reported, and will be published in the bulletin on the Sparrow question.

The Sparrow an enemy to the gardener and fruit-grower.

In addition to the indirect injury thus brought about by depriving our gardens and orchards of the protection afforded by our native insectivorous birds, the Sparrows cause a positive and direct loss to our agricultural industries amounting in the aggregate to not less than several millions of dollars per annum. The damage done by the Ricebird is limited to a single crop, and takes place during a few weeks in spring and fall, but the ravages of the English Sparrow affect almost every crop produced by the farmer, fruit-grower, and truck gardener, and extend over the entire year. Indeed, it is safe to say that it now exerts a more marked effect upon the agricultural interests of this country than any other species of bird; and its unprecedented increase and spread, taken in connection with the extent of its ravages in certain districts, may be regarded with grave apprehension. In the early spring it prevents the growth of a vast quantity of fruit by eating the germs from the fruit-buds of trees, bushes, and vines, of which the peach, pear, plum, cherry, apple, apricot, currant, and grape suffer most.

"Lettuce, peas, beets, radishes, cabbages, and cauliflower are attacked in turn, and devoured as soon as they show their heads above the ground, and in many cases the seed is taken out of the earth before it has germinated. So extensive is the injury thus done, that in many localities it has been found necessary to cover the garden-beds with netting. Whenever the buds are so fortunate as to escape, the ripening fruit appeals strongly to the Sparrow's appetite, and different varieties are attacked, injured, or destroyed in turn as they mature. All sorts of garden products, vegetables, berries, grapes, and even the larger fruits, are greedily fed upon or mutilated to such an extent as to unfit them for market. The magnitude of the havoc wrought in orchards and vineyards is shown by the melancholy accounts given by fruit-growers in every section of the country where it has become numerous." (Hoadley MS.)

Mr. Jabez Webster, of Centralia, Ill., writes:

I have seen flocks of fifty or more stay about my raspberries, constantly flying backwards and forwards, taking quarts of the best fruit, and coming very close to the pickers.

Mr. W. C. Percy, of Black Hawk, La., writes:

They destroy more tomatoes, peas, beans, &c., than any other bird. In 1884 and 1885 they ruined the peach and apple crop.

Mr. John H. Strider, of Halltown, W. Va., writes:

It nips fruit blossoms, destroys early peas and cabbages, and later in the season garden seeds; is very destructive to sunflower seed.

Norman A. Wood, of Saline, Mich., writes:

They eat green peas as fast as they grow; also raspberries, blackberries, and strawberries.

H. H. Beeson, of New Market, N. C., writes:

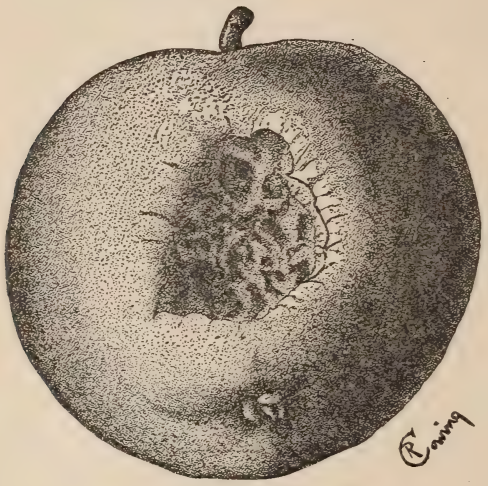
They peck grapes, strawberries, tomatoes, plums, peaches, and pears, causing them to decay.

Mr. F. M. Webster, of La Fayette, Ind., writes:

The English Sparrow is destroying my apples. I have two or three trees in my garden, and as soon as the fruit gets mellow the Sparrows peck holes in it, and it

either drops to the ground or decays on the trees. These birds are worse than all other apple pests combined. I can hardly get a single apple fit to eat; they have destroyed nearly if not quite three-fourths of them. A neighbor across the way is troubled in the same manner.

An apple pecked as above described and kindly sent to the Department by Mr. Webster is figured in the accompanying cut.



APPLE PECKED BY ENGLISH SPARROWS.

From orchard of F. M. Webster, Lafayette, Indiana, October 7, 1885.

The Sparrow an enemy to grape culture.

The grape industry, which is one of rapidly increasing consequence in this country, encounters in the English Sparrow an enemy second only to the *Phylloxera* and certain fungus growths. Already in some parts of the East it has become such a scourge that grape culture can no longer be carried on with profit, it being necessary to inclose the ripening clusters in bags to insure their protection. At the end of the season of 1886 bitter complaints of damage done the grape crop by Sparrows had reached the Department from twenty-five States and the District of Columbia, as follows: Alabama, Arkansas, California, Connecticut, District of Columbia, Georgia, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Mississippi, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, and West Virginia.

In California, where this industry is of paramount importance, the English Sparrow has taken firm root and is multiplying and spread-

ing with ominous rapidity: and unless steps are taken to wipe out the pest at the earliest possible moment the result will entail a loss to the State of many thousands, if not millions, of dollars. In this connection it is not reassuring to read, in the evidence collected and published by the Australian Government in 1881, that "in the short space of ten days the Sparrows took a ton and a half of grapes" from the vineyard of John Chambers, of South Richland. Of the hundreds of testimonials which have been sent the Department of Agriculture by practical fruit-growers, the following are suggestive examples:

Mr. F. S. Platt, of New Haven, Conn., writes:

Last year, when I had a large crop of very fine grapes, I found that the Sparrows were destroying nearly all of them. I watched the birds, and found that they would pick out a fine bunch of fruit and peck a hole in nearly every grape. This hole would be so very small that at first it would not be noticed, but very soon the place would begin to decay, and then the grape would be ruined.

The postmaster at Bowling Green, Ky., writes:

It has ruined the grape crop almost wholly where unprotected.

Mr. Witmer Stone, of Germantown, Pa., writes:

It frequently despoils whole grape-vines of their fruit, and pecks the bunches so that they have to be protected by paper bags.

Mr. Thomas S. Kennedy, of Crescent Hill, Ky., writes:

It eats strawberries, raspberries, and grapes. This past season it has been unusually destructive, and has torn the paper bags from the bunches of grapes. It also eats holes in apples and pears hanging on the trees.

The Sparrow an enemy to the grain-grower.

"Annoying and injurious as the Sparrow is to the fruit-grower and vegetable gardener, the loss it inflicts on the producer of cereals is even greater. Though for its permanent residence it prefers populous localities and places of abundant traffic and commotion, still, in anticipation of the harvest season, it gathers in enormous flocks, and, leaving the cities and towns, moves off into the surrounding country to feed upon the ripening grain. Its consumption and waste of corn, wheat, rye, oats, barley, and buckwheat in many parts of the country is enormous. It feeds upon the kernel when it is in the soft, milky state, as well as when it has matured and hardened: and in fields of ripe grain it scatters upon the ground even more than it consumes. Instances have been reported where in the place of a full or fair crop only the straw remained to be gathered."—(Hoadley MS.)

Mr. Andrew Gray, of Willoughby, Ohio, in a recent letter to the Commissioner of Agriculture, states:

This is to inform you that I drilled in the seed-wheat which you sent me. I sowed it on rich sandy soil, and it came through the winter well and gave promise of a splendid crop, especially the Diehl Mediterranean, which looked the most promising, although the Martin Amber did very well. But alas for human hopes! About four or five days before it was ready to cut I went to see how it was getting along, and found that the English Sparrows had harvested the crop. Their first choice was the Martin Amber, the next was the Diehl Mediterranean, and the last the Clawson. I saved about a peck of seed. I think I can safely say that I would have got as much as one and one-half bushels of seed from the two quarts of seed you sent me if the Sparrows had let it alone.

Mr. William Holmead, of Mount Pleasant, D. C., whose business it is to raise fruits, vegetables, and grain for the market, writes:

In 1882 I put part of my farm in wheat. After cutting and shocking it the Sparrows came by thousands and destroyed every head of grain exposed; after it was stacked preparatory to thrashing they covered the whole stack. I had to shoot at them two or three times a day to scare them away, and upon thrashing it was estimated that fully one-tenth of the crop was destroyed. One of my neighbors estimated that one-half of his wheat was eaten by the Sparrows last year. This year I had about four acres in oats. When the oats were put in the barracks the field was filled with thousands of Sparrows, and when they had cleaned the field they attacked

the oats in the barracks and destroyed all that was exposed. Sugar and field corn when green are very much damaged by them. They tear the ends of the ears and eat the corn in the same manner as Crows.

Dr. B. Harry Warren, State ornithologist of Pennsylvania, writes:

The Sparrow greatly damages the corn crop, tearing open the husks, devouring the tender part of the ear, and exposing the remainder to the ravages of insects and to atmospheric changes. It alights on fields of wheat, oats, and barley, consuming a large quantity, and, by swaying to and fro on the slender stalks and flapping its wings showers the remainder on the ground.

Mr. S. M. Clark, of the District of Columbia, states:

The Sparrows stripped my entire crop of pearl millet, not leaving a kernel on the ear.

Mr. Robert Ridgway, ornithologist of the United States National Museum, writes:

In the summer of 1886 I saw flocks of hundreds of English Sparrows feeding on grain in stacks in Prince William County, Virginia; have also seen the same elsewhere.

Mr. Frank S. Platt, of New Haven, Conn., writes:

Cradled a small piece of oats, and the Sparrows gathered on the shocks in such flocks that I shot fifty-four with one barrel and thirty-five with the other. In our seed gardens we had to keep a boy all the time to prevent waste of turnip, cabbage, and other seeds.

Mr. John Cordeaux, the veteran ornithologist of England, says he has seen acres of grain which had the appearance of having been thrashed with a flail after it had been invaded by the Sparrows.

Already the English Sparrow has invaded the rice fields in certain parts of the South, where it threatens to rival the Bobolink in the extent of its ravages. Indeed, one planter writes from Plaquemines Parish, Louisiana, that it is more destructive now than the Rice-bird or Blackbird.

Effect on architecture, and defilement of buildings.

"That the Sparrow exerts a very appreciable influence on architecture can be readily observed in the modifications which its presence has rendered necessary in cornices, gables, jutting portions of roofs, and the various devices made use of in the elaboration and embellishment of edifices, both public and private."—(Hoadley MS

In addition to the disfigurement of buildings by the nests and excrement of the Sparrows, and the injury to ornamental trees and shrubs resulting from the same cause, it should be mentioned that they frequently damage and sometimes destroy the ivy and woodbine covering the walls of churches and other edifices.

Mr. Robert Ridgway, of the Smithsonian Institution, says:

The Sparrows injure ornamental vines, &c., by chemical action of their excrement. The luxuriant English ivy that once covered portions of the Smithsonian building was thus totally destroyed by them.

Mr. Eli Whitney Blake, 3d, of Providence, R. I., writes:

The sexton of St. John's church, in this city, took 970 eggs and two cart-loads of nests *at one time* from the ivy covering the walls of that church.

Failure of the Sparrow as an insect-destroyer.

The English Sparrow was brought to this country in the belief that it was an insectivorous bird, and with the expectation that it would rid our cities of the caterpillars which destroy the foliage of the elms and other shade trees in the streets and parks. The utter futility of this hope has been demonstrated over and over again in hundreds of

our cities and larger towns which are overrun with Sparrows, and where the trees have been repeatedly defoliated and disfigured by the worms. Cases are known in which the very boxes occupied by the Sparrows have been covered with webs, where the cocoons have been attached to the boxes, and the larvæ have hatched and crawled away within a few inches of the birds without molestation. Indeed, it is an every-day occurrence in summer to see Sparrows hopping about on fences and branches fairly swarming with caterpillars and measure-worms, in whose presence they rarely manifest the slightest interest. It is true that they destroy some insects, particularly when feeding their young, but it would be presumptuous to say that the number thus destroyed is greater than the number consumed by the truly insectivorous birds which the Sparrows have driven away.

English Sparrows cause an increase in the number of caterpillars.

Prof. J. A. Lintner, State entomologist of New York, has made a special study of the cause of the increase of the caterpillars of the tussock moth (*Orgyia leucostigma*), which is very destructive to the foliage of shade and fruit trees and ornamental shrubs. The results of Professor Lintner's investigations, extending over a period of years, have led him to make the following unqualified statement:

The extraordinary increase of the *Orgyia leucostigma* is owing to the introduction and multiplication of the English Sparrow.

His subsequent remarks under this head are so valuable, that I make no apology for introducing them in full. He says:

This may seem a strange statement, in consideration of the fact that the Sparrow was imported from Europe for the express purpose of abating the "caterpillar nuisance" in New York and some of the New England cities. * * * The increase of the *Orgyia leucostigma* commenced and has continued to progress with that of the Sparrow.

A remark made to me that the caterpillars had been observed to be very numerous in localities where the Sparrows also abounded induced me to undertake to verify or disprove the idea that had suggested itself to me, that the Sparrow afforded actual protection to the caterpillars and promoted their increase.

In a locality in the city [of Albany, New York] (intersection of Broadway and Spencer streets) which I had traversed daily during the preceding year, I had been interested in watching the habits of a large company of Sparrows, which had established themselves in quarters evidently in every way suited to their taste and wants, among the vines and leaves of a large woodbine (*Ampelopsis quinquefolia*), which covered with a dense matting nearly the entire side of a large dwelling. Here I had observed a greater number of the Sparrows than elsewhere in the city. They were still local, and far from being generally distributed.

Upon visiting this locality for the purpose above mentioned, I found upon the other side of the building, and on an adjoining one, three other large woodbines not before noticed by me, making five in all. On a tall pole standing between the two buildings a very large sparrow-house, with many compartments, had been erected, and many smaller ones had been placed among the branches of the trees. The woodbines seemed alive with the Sparrows. Hundreds were issuing from them and dropping down to their favorite stercoraceous repasts in the streets, and the air was vocal with their chattering. It was a rare bird exhibition. Here certainly was a test case of the insectivorous nature of the Sparrow.

On the sidewalk in front of the two buildings two large spreading elms (*Ulmus Americanus*), standing between some maples, showed *every leaf eaten from them*, disclosing the nesting-boxes among their branches, and their trunks and limbs dotted thickly or clustered with the easily recognized egg-bearing cocoons of the *Orgyia*. Hundreds of immature caterpillars were traveling over the trees, fences, and the walls adjoining. No better evidence of the almost perfect immunity afforded to the caterpillars from their enemies, whether birds or insects, by the presence of the Sparrows, could possibly be given.

A portion of Broadway, between Clinton avenue and the Central Railroad crossing, was also known to abound in the Sparrows, the citizens resident there having fed

them most generously, not only during the winter season, but also in the summer months. Nesting-boxes had been placed for them in most of the trees. Here the trees presented a pitiable sight. Many of the elms and horse-chestnuts were entirely stripped of their foliage: the naked ribs of the leaves of the latter seemed ghastly in their suggestion of fleshless fingers. Nowhere else in the city had I seen such ravages.

Passing thence to Pearl and State streets, the same association of Sparrows, caterpillars, and their destructive work was seen. Clinton Square, where the Sparrows had, in their introduction into the city, been specially taken under the care and protection of the residents on the east side of the park, afforded another excellent test. It was evident that the Sparrows were in full appreciation of their privileges from the almost incredible numbers sporting about the trees. Their protégés were also in full force. Caterpillars and their cocoons met the eye everywhere, while hanging from the rails and caps of the iron fence surrounding the park were the dead and decomposing bodies of caterpillars killed by the recent heavy rains (often so fatal to insect larvæ), in such numbers that they tainted the air in their vicinity.

It seems unnecessary to extend this record further than to add that in other sections of the city observations made were in accord with the above.

HOW THE SPARROWS PROTECT THE CATERPILLARS.

That the Sparrows decline to eat the Orgyia caterpillar is not a charge against them. They *could not* eat them with impunity. The diet would doubtless prove fatal to them. The charge to which they are amenable is this: By the force of numbers, united to a notoriously pugnacious disposition, they drive away the few birds that would feed upon them. Of these we know but four species, viz: The Robin (*Merula migratoria*), the Baltimore Oriole* (*Icterus galbula*), the Black-billed Cuckoo (*Coccygus erythropthalmus*), and the Yellow-billed Cuckoo (*Coccygus Americanus*). The above species seem, in the ordering of nature, to have been assigned to us for protection from an undue multiplication of a large number of hairy caterpillars of injurious habits. * * * One of them, the Yellow-billed Cuckoo, is known to shave off the hairs of the *Orgyia leucostigma* caterpillar before swallowing it. The following account of the operation is from Dr. Le Baron, former State entomologist of Illinois: "My attention was attracted to a Cuckoo regaling himself upon these caterpillars, which were infesting in considerable numbers a larch growing near the house. My curiosity was excited by seeing a little cloud of hair floating down upon the air from the place where the bird was standing. Upon approaching a little nearer I could see that he seized the worm by one extremity, and, drawing it gradually into his mouth, shaved off, as he did so, with the sharp edge of his bill the hairy coating of the caterpillar and scattered it upon the wind."

Under the head of Preventives and Remedies, Professor Lintner advises "a relentless war upon the English Sparrows," and states that the removal of this bird "would also serve to diminish the losses annually sustained in our orchards, forests, and gardens from the following well-known noxious species: The apple-tree tent-caterpillar (*Clisiocampa Americana*), the forest tent-caterpillar (*Clisiocampa sylvatica*), the fall web-caterpillar (*Hyphantria textor*), the yellow-necked apple-tree caterpillar (*Datana ministra*), the yellow woolybear (*Spilosoma virginica*), and many others of the kind." (Second report on the Injurious and other Insects of the State of New York, by J. A. Lintner, Albany, 1885, pp. 80–83.)

Miss Eleanor A. Ormerod, consulting entomologist to the Royal Agricultural Society of England, in her ninth report on Injurious Insects and Common Farm Pests for 1885, states that the Sparrows drive off Swallows and Martins, thus permitting a great increase in flies and insects "destructive in the garden and orchard." Miss Ormerod cites a case in which the destruction of the Sparrows and consequent reappearance of Swallows and Martins resulted in the abolishment of the insect pest.

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*This bird has been seen with its head thrust into the web-nest of the tent-caterpillar, eagerly devouring its occupants.

Mr. J. H. Gurney, Jr., a well-known British ornithologist, says:

I think they do enough harm to warrant everybody in destroying them. Say one-fifth of good to four-fifths of harm is about what they do, take the country all over, *though at certain times and places they do nothing but harm.* I have striven to say all I could in their favor, being naturally a lover of birds.

The destructive habits of the English Sparrow in Bermuda, Cuba, England, Germany, Austria, Russia, India, Egypt, and Australia are too well known to require more than passing observation. In England alone the damage it causes has been estimated as not less than $3,850,000 per annum, and in Australia the loss is much greater. It threatens to become a more baneful pest to the American farmer and horticulturist than the grasshopper, caterpillar, and Colorado beetle.

Recommendations for legislation.

The following recommendations are respectfully submitted to the legislative bodies of the various States and Territories:

(1) The immediate repeal of all existing laws which afford protection to the English Sparrow.

(2) The enactment of laws legalizing the killing of the English Sparrow at all seasons of the year, and the destruction of its nests, eggs, and young.

(3) The enactment of laws making it a misdemeanor, punishable by fine or imprisonment, or both—(*a*) to intentionally give food or shelter to the English Sparrow, except with a view to its ultimate destruction: (*b*) to introduce or aid in introducing it into new localities: (*c*) to interfere with persons, means, or appliances engaged in, or designed for, its destruction or the destruction of its nests, eggs, or young.

(4) The enactment of laws protecting the Great Northern Shrike or Butcher Bird, the Sparrow Hawk, and the Screech Owl, which species feed largely on the English Sparrow.

(5) The enactment of laws providing for the appointment of at least one person holding civil office, preferably the game constable, where such officer exists, in each town or village, who shall serve without additional compensation, and whose duty it shall be to destroy or bring about the destruction of English Sparrows in the streets and parks and other places where the use of fire-arms is not permitted. In the larger towns and cities this office might be well imposed upon the commissioners of public parks.

It is not expedient to offer bounties for the destruction of Sparrows. In fact, at the present time it is desirable, and perfectly feasible, to bring about a great reduction in their ranks by concerted action of the people, aided by helpful legislation, without drawing upon the public purse.

Recommendations to the people.

The English Sparrow is a curse of such virulence that it ought to be systematically attacked and destroyed before it becomes necessary to deplete the public treasury for the purpose, as has been done in other countries. By concerted action, and by taking advantage of its gregarious habits, much good may be accomplished with little or no expenditure of money.

The Sparrow is a cunning, wary bird, and soon learns to avoid the means devised by man for its destruction. Hence much sagacity must be displayed in the warfare against it. In the winter-time, if

food is placed in some convenient spot at the same hour each day for a week, the Sparrows will gather in dense flocks to feed, and large numbers may be killed at one time by firing upon them with small shot. Sometimes they may be successfully netted or trapped, but this requires considerable skill. They may be poisoned by grain soaked in tincture of nux vomica or in Fowler's solution of arsenic, but poisoning is attended with some danger, and should be attempted only by official sparrow-killers.

Large numbers may be destroyed and increase prevented by the systematic destruction of their nests, eggs, and young. By the aid of an iron rod and hook, set in the end of a long pole, most of their nests can be reached and brought down. This method promises most satisfactory results.

They may be easily driven from their roosting-places by disturbing them on several successive nights. A very efficacious method is to throw water upon them when at roost. In cities where hose-pipe is available the process is simple and certain. They may be kept out of ornamental vines in the same manner, particularly in the breeding season, when a thorough soaking not only disconcerts the old birds and kills their young, but at the same time does much good by wetting the vines and washing out their filth.

The Sparrow as an article of food.

In this connection it should not be forgotten that the English Sparrow is an excellent article of food, equaling many of the smaller game birds. In fact, at restaurants it is commonly sold under the name of "Rice-bird," even at times of the year when there are no Rice-birds in the country.

Prof. J. A. Lintner, State entomologist of New York, informs me that English Sparrows are now sold largely in the market at Albany, N. Y., "one dealer reporting a monthly sale of about 2,000."

RAVAGES OF RICE-BIRDS.

One of the most important industries of the Southern States, the cultivation of rice, is crippled and made precarious by the bi-annual attacks of birds. Many kinds of birds feed upon rice, but the bird which does more injury than all the rest combined is the Bobolink of the North (*Dolichonyx oryzivorus*), called "Reed-bird" along the Chesapeake, and "Rice-bird" in the South.

Next in importance after the Bobolink is the Red-shouldered Blackbird (*Agelaius phœniceus*), which does much harm and some good, as will appear later. Still another blackbird figures prominently in the rice fields; it is the large Boat-tailed Grakle (*Quiscalus major*), called "Jackdaw" by the planters.

The name of the "Rice-bird" is familiar to most persons in the North, but the magnitude of its depredations is hardly known outside of the narrow belt of rice fields along the coasts of a few of the Southern States. Innumerable hosts of these birds visit the rice fields at the time of planting in spring, devouring the seed-grain before the fields are flooded, and again at harvest-time in the fall, when, if the maturing grain is "in the milk," they feed upon it to a ruinous extent.

To prevent total destruction of the crop during the periods of bird invasion, thousands of men and boys, called "bird-minders," are em-

ployed, hundreds of thousands of pounds of gunpowder are burned, and millions of birds are killed. Still the number of birds invading the rice fields each year seems in no way diminished, and the aggregate annual loss they occasion is about $2,000,000.

The use of fire-arms has continued for more than a century, but has proved an expensive and inefficient remedy. Hence it is clear that some other means consistent with reasonable economy must be devised for the relief of the enormous losses now sustained by rice-growers from the depredations of birds.

Statistics showing the total quantity of rice annually produced in the United States are wanting, except for the year 1879-1880, when, according to the Tenth Census, the crop amounted to 110,131,373 pounds, worth, at 6 cents per pound, $6,607,882.38. In that year the product by States was as follows:

Rice produced in the United States in 1879–1880.

	Pounds.
Alabama	810,889
Florida	1,294,677
Georgia	25,369,687
Louisiana	23,188,311
Mississippi	1,718,951
North Carolina	5,609,191
South Carolina	52,077,515
Texas	62,152
	110,131,373

Value, at 6 cents per pound, $6,607,882.38.

Since 1880 the rice crop of Louisiana has more than doubled in quantity and value, but that of the other States has not increased in the same ratio.

As a rule the annual consumption of rice in the United States is almost double the production, as shown by the following table:

Table showing the quantities and values of the several kinds of rice imported, the total value, and the duty, each year, from 1880 *to* 1886 *inclusive.*

Years.	Dutiable.					
	Cleaned.		Uncleaned.		Paddy.	
	Pounds.	*Dollars.*	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*
1880	46,314,785	1,212,508 53	359,668	9,316 48	249,066	4,707 00
1881	41,918,444	995,098 01	243,756	5,657 67	12,309	264 30
1882	63,253,521	1,417,467 84	618,633	9,994 32	2,651	45 00
1883	63,909,474	1,391,741 98	1,942,212	36,967 00	111,375	1,363 57
1884	64,098,827	1,378,263 71	9,158,943	174,149 00	8,112	146 00
1885	58,850,662	1,242,821 68	10,264,604	209,773 00	559,670	9,502 00
1886	43,497,923	870,262 93	5,294,005	110,722 50	144,330	3,536 00

Years.	Dutiable.	Free.		Total.	Total duties.
	Rice flour.*				
	Dollars.	*Pounds.*	*Dollars.*	*Dollars.*	*Dollars.*
1880	68,218 44	5,052,646	294,185 59	1,588,936 04	1,182,442 71
1881	67,190 74	6,986,306	389,016 80	1,457,227 52	1,069,329 07
1882	239,001 38	10,175,578	499,825 77	2,166,334 31	1,668,131 21
1883	463,335 24	12,926,951	610,323 60	2,503,731 39	1,753,907 30
1884	*517,851 77	12,398,433	558,476 00	2,628,886 48	1,683,365 94
1885	*672,092 06	8,291,360	404,477 50	2,538,666 24	1,619,576 25
1886	627,003 28	6,892,900	361,567 00	1,973,091 71	1,184,256 81

*Rice flour and meal.

In quality the imported rice is decidedly inferior to that grown in this country, and the price paid for it is correspondingly lower. The duty, however, is enormous, nearly equaling the cost. If, therefore, the bird plague can be abolished or reduced to comparative harmlessness, it is evident that great benefit will accrue both to the producer and the consumer; for, the home demand being greater than the home supply, the planter will profit by increased production and lessened expense; while the consumer will gain by securing a uniformly good quality of rice, of much higher nutritive value than the imported.

Among the numerous letters from rice-growers which have been received at the Department of Agriculture, asking for assistance in the attempt to secure some practicable remedy for the destructive ravages of birds, the following will serve to indicate the extent of the losses sustained in South Carolina, Georgia, and Louisiana:

Letter from Col. John Screven, of Savannah, Ga., President of the Georgia Rice-growers' Association.

In reply to your favor, requesting information concerning the depredations of the Bobolink or Rice-bird in the rice fields of my neighborhood, I furnish such information as I have with pleasure, hoping that it may assist in the discovery of some effective and economical means of arresting the ravages of this chief bird pest in the rice fields.

The Rice-bird is strictly migratory. It appears on the Savannah River commonly about the 10th or 15th of April, and remains, perhaps, until the 29th of May. During this incursion it is known as the "May-bird." It appears again about the 15th of August, when the early grain is hardened and is not so inviting to his appetite as when unripe and in the milk. The planter, observing these dates, seeks therefrom to seed the land and to have the young rice under what is known as the "stretch flow" before the spring flocks arrive, and to have the grain ripened before the autumn flocks return. If his planting is not finished before the spring flocks come, it will be delayed until late in May or early in June, when the birds have departed for the season. He looks to the ripening and harvesting of such late crops when the fall ravages of the Rice-bird have either ceased or are much diminished.

These data show how the destructiveness of the Rice-bird is in some measure avoided, and in part by taking advantage of the periodicity of its migrations; but despite the precautions so taken its invasions are ruinous to fields on which its flocks may settle, especially if the grain is in palatable condition and is on fields adjacent to marshes convenient for ambush or retreat. Bird-minders, armed with muskets and shot-guns, endeavor by discharges of blank cartridges to keep the birds alarmed and to drive them from the field. Small shot are also fired among them, and incredible numbers are killed; but all such efforts will not prevent great waste of grain, amounting to a loss of large portions of a field—sometimes, indeed, to its entire loss. The voracity of the birds seems so intense that fear is secondary to it, and they fly, when alarmed, from one portion of the field to another, very little out of gunshot, and immediately settle down again to their banquet.

As evidence of the numbers present of this bird and of the numbers killed in the rice-fields, a neighboring planter informs me that in 1884 he permitted four pot-hunters (contrary to the ordinary régime) to shoot in his fields, and in the course of the fall season they slaughtered and accounted for eight thousand Rice-birds. On every plantation large numbers are killed, and yet the visible supply of these robbers of the air does not seem in the least diminished. Every year the same numbers seem to swarm, and with wonderful prescience of the date of the coming harvest.

The Rice-bird comes only in seed-time and harvest to prey, so far as the rice fields are concerned, on crops raised at more cost and peril than any other known in agriculture.

The preventives now in use against its ravages have been already mentioned, but they are palliative only, applied at great expense, and without commensurate results. No vigilance on the part of the planter can do away with the wastefulness of powder and shot in the hands of careless and dishonest bird-minders. They only too often add the cost of wasted grain to the cost of their own faithless and ill-directed labor. In short, no effort yet tried, consistent with reasonable economy, will drive the Rice-birds from the fields or afford any well-founded promise of their reduction to harmless numbers.

Extracts from a letter from Capt. William Miles Hazzard, of Annandale, S. C., one of the largest rice-growers in the State.

The Bobolinks make their appearance here during the latter part of April. At that season their plumage is white and black, and they sing merrily when at rest. Their flight is always at night. In the evening there are none. In the morning their appearance is heralded by the popping of whips and firing of musketry by the bird-minders in their efforts to keep the birds from pulling up the young rice. This warfare is kept up incessantly until about the 25th of May, when they suddenly disappear at night. Their next appearance is in a dark-yellow plumage, as the Rice-bird. There is no song at this time, but instead a chirp, which means ruin to any rice found in milk. My plantation record will show that for the past ten years, except when prevented by stormy south or southwest winds, the Rice-birds have come punctually on the night of the 21st of August, apparently coming from seaward. All night their chirp can be heard passing over our summer homes on South Island, which island is situated six miles to the east of our rice plantations, in full view of the ocean. Curious to say, we have never seen this flight during the day. During the nights of August 21, 22, 23, and 24 millions of these birds make their appearance and settle in the rice fields. From the 21st of August to the 25th of September our every effort is to save the crop. Men, boys, and women are posted with guns and ammunition to every four or five acres, and shoot daily an average of about one quart of powder to the gun. This firing commences at first dawn of day and is kept up until sunset. After all this expense and trouble our loss of rice per acre seldom falls under five bushels, and if from any cause there is a check to the crop during its growth, which prevents the grain from being hard, but in milky condition, the destruction of such fields is complete, it not paying to cut and bring the rice out of the field. We have tried every plan to keep these pests off our crops at less expense and manual labor than we now incur, but have been unsuccessful. Our present mode is expensive, imperfect, and thoroughly unsatisfactory, yet it is the best we can do. I consider these birds as destructive to rice as the caterpillar is to cotton, with this difference, that these Rice-birds never fail to come. If the Government could devise some means to aid us in keeping off these birds it would render us great assistance. The loss by birds and the expense of minding them off in order to make anything renders the cultivation of rice a dangerous speculation. During the bird season we employ about one hundred bird-minders, who shoot from three to five kegs of powder daily, of twenty-five pounds each; add to this shot and caps, and you will have some idea what these birds cost one planter.

From Theo. S. Wilkinson, Myrtle-grove plantation, lower coast, Louisiana.

The rice crop in Louisiana, from the time the rice is in the milk till harvest time and during harvesting, is much damaged by birds, principally the Red-shouldered Blackbird. Shooting is the only remedy thus far resorted to which is at all effective, and it is only partially so. I have known rice crops to be destroyed to the extent of over 50 per cent., which is a loss of say $13 per acre. While this is an extreme case, a damage and expense of from $5 to $10 per acre is very common.

The average yield per acre is about 30 bushels, worth now (March 12, 1886) about 80 cents per bushel.

Early in the progress of the work a special circular to rice-growers was prepared (Circular 5, see p. 234), and copies were sent to all planters whose addresses the division was able to secure. The replies received were so startling in the magnitude of the losses they revealed, that it was thought advisable to make a thorough study of the whole subject of rice culture, and to investigate on the spot the manner in which the ravages were committed, in the hope of devising some means, compatible with reasonable economy, for lessening their extent. With this object in view the assistant ornithologist, Dr. A. K. Fisher, was sent on an extended tour through the rice-growing districts of the Southern States, from Charleston to New Orleans. His investigations were carried on in the spring, at and shortly after the time of planting. At harvest-time in the fall I visited the rice fields of portions of South Carolina and Georgia, and witnessed in person the destructive ravages of the birds at the height of the season. Furthermore, to render the investigation still more complete, the

Department has employed a special field agent, Col. Alexander Macbeth, whose headquarters are at Georgetown, S. C., in the very heart of one of the largest rice-growing districts. The results of all these investigations will be given in full in a forthcoming bulletin of the division.

THE DISTRIBUTION AND MIGRATION OF BIRDS.

The work of the Department on the Geographical Distribution and Migration of Birds is sufficiently outlined in the following circular, several thousand copies of which have been distributed by the division:

[Circular No. 8.]

CIRCULAR ON THE GEOGRAPHICAL DISTRIBUTION AND MIGRATION OF NORTH AMERICAN BIRDS FOR 1887.

Through the courtesy of the American Ornithologists' Union, the Department of Agriculture has secured the co-operation of this organization, and has undertaken to carry on the work begun by the Union on the migration and geographical distribution of North American birds.

The Department wishes to ascertain the whereabouts of all our birds during the winter season and the times of leaving their winter homes; to determine, if possible, the number and extent of the chief avenues of migration in North America, and the average rate of speed at which the different species travel; to find out the dates of their appearance at and disappearance from at least a thousand localities, both in spring and fall, for a period of years; and to map out the breeding areas of every species which rears its young in North America north of Mexico.

In order to obtain this information it is necessary to secure the voluntary services of a large corps of observers, each of whom is requested to contribute as full data as possible concerning the questions mentioned in this circular.

The first item in an observer's report should be a brief but careful description of the principal physical features, including latitude, longitude, and altitude, of the locality which is the seat of his observations.

The data collected may be arranged conveniently in three general classes: (*a*) ornithological phenomena; (*b*) meteorological phenomena; (*c*) contemporary and correlative phenomena.

(*a*) *Ornithological phenomena.*

Each observer is requested to prepare, at his earliest convenience, a complete list of the birds known to occur in the vicinity of his station, and to indicate (by the abbreviations inclosed in parentheses) to which of the following five categories each species pertains:

(1) Permanent residents, or those that are found regularly throughout the year (R).

(2) Winter visitors, or those that occur only during the winter season, passing north in the spring (WV).

(3) Transient visitants, or those that occur only during the migrations, in spring and fall (TV).

(4) Summer residents, or those that are known to breed, but which depart southward before winter (SR).

(5) Accidental visitants, or stragglers from remote districts (AV).

It is desirable also to indicate the relative abundance of the different species, the terms to be employed for this purpose being: Abundant, Common, Tolerably Common, Rare.

If you are in a position to observe the lines of flight of birds, have you noticed whether or not such lines are influenced by the topography of the country, and if so, to what extent?

If a mountain intercepts the line of flight, what kinds of birds pass around it, and what kinds pass over it?

What localities in your neighborhood are sought as resting-places by the various kinds of migrating birds? Can you give any reason for this selection?

What kinds of birds generally move in flocks, and what kinds in pairs or singly?

Are you familiar with any kinds of birds in which the males and females, and old and young, fly in separate flocks? In many species the males arrive in advance of the females, hence it is important to note the sex of the first comers, and the data at which the opposite sex is first seen.

Have you observed from year to year any increase or decrease in the numbers of any kind of bird known to you? If so, do you attribute such change to altered conditions in the bird's breeding-grounds? If not, can you assign a cause?

Have you observed the increase or decrease of one species to affect the numbers of another species? If so, can you explain the fact?

Has any kind disappeared altogether, and if so, can you assign a cause for this disappearance?

Among the birds which are now common about your station is there any kind that was formerly rare or absent? If so, can you explain the fact?

Among the birds which breed regularly in your vicinity have you ever observed an individual which by some personal peculiarity (such as the presence of white or dark feathers where they do not belong, or by some deformity) could readily be distinguished from others of its kind? If so, has this bird returned to the same place to nest year after year?

In recording arrivals and departures, it is highly important to distinguish between the movements of irregular stragglers of the advance guard or "van," and of the principal mass or "bulk" of the species. For this purpose observers are requested to note: (1) when the species is first seen; (2) when it is next seen; (3) when it becomes common; (4) when the bulk departs; (5) when the last individual is seen.

In addition to the above data, which *all* observers are requested to furnish, the Department particularly desires exact records of every increase and decrease in the numbers of a given species over a given area; for it is only by the knowledge of the daily fluctuations of the same species in the same place that the progress and movements of a "flight," or "bird-wave," can be traced. Such data can be contributed by experienced observers only, and in their procurement much time must be spent in the field. During the progress of the migratory movement the observer should go over the same ground day after day, and, if possible, both early in the morning and late in the afternoon. He should visit wood-lands, thickets of dense undergrowth, and open fields, and, if possible, both swamp and upland should fall under his daily scrutiny.

The above may be regarded as *essential data*. There are many other noteworthy details that bear more or less directly upon the complicated problems involved in the study of migration. Among such may be mentioned the bodily condition of the bird (whether fat or lean), the molt, and the period of song. The time of mating, when observed, should always be recorded.

The Department desires positive information concerning the food of all birds, and will furnish, on application, a special circular devoted to this branch of the inquiry.

(*b*) *Meteorological phenomena.*

Information is desired upon—

(1) The direction and force of the wind.

(2) The direction, character, and duration of storms.

(3) The general conditions of the atmosphere, including rainfall.

(4) The succession of marked warm and cold waves, including a record of all sudden changes of temperature.

(*c*) *Contemporary and correlative phenomena.*

The Department desires that the data under this head be as full and complete as possible, and requests exact information upon—

(1) The date at which the first toad is seen.

(2) The date at which the first frog is heard.

(3) The date at which the first tree-toad or "peeper" is heard.

(4) The dates at which certain mammals and reptiles enter upon and emerge from the state of hibernation.

(5) The dates at which various insects are first seen.

(6) The dates of the flowering of various plants.

(7) The dates of the leafing and falling of the leaves of various trees and shrubs.

(8) The dates of the breaking up and disappearance of ice in rivers and lakes in spring, and of the freezing over of the same in the fall.

It must not be supposed, because a large amount of information upon a variety of subjects is asked for, that meager or isolated records are not desired. Quite the contrary is true. Comparatively few of the observers are ornithologists, or even bird collectors—the great majority being intelligent farmers, tradesmen, and light-keepers. Those who know only the commonest birds, such as the Robin, Bluebird, Bobolink, Martin, Humming-bird, and Chimney Swift, can furnish important data, and their services are eagerly sought.

In order to secure better results, a portion of the territory under investigation has been divided into districts, each of which has been placed under the immediate direction of a competent superintendent. Observers not living within the limits of these several districts are requested to communicate with the Ornithologist of the Department of Agriculture.

The districts, with their respective superintendents, are:

New England.—Superintendent, John H. Sage, Portland, Conn.

Atlantic district.—New York (except Long Island), Pennsylvania, New Jersey, Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Kentucky, and Tennessee. Superintendent, Dr. A. K. Fisher, Department of Agriculture, Washington, D. C.

Long Island, N. Y.—Superintendent, William Dutcher, 51 Liberty street, New York City.

Indiana and Southern Michigan.—Superintendent, B. W. Evermann, Terre Haute, Ind.

Ohio.—Superintendent, Dr. F. W. Langdon, 65 West Seventh street, Cincinnati, Ohio.

Light-house division of North America.—Superintendent, Dr. C. Hart Merriam, Department of Agriculture, Washington, D. C.

Light-house division of Spanish America.—Superintendent, L. S. Foster, 35 Pine street, New York City.

Schedules on which to record the more prominent facts relating to bird migration will be furnished on application.

The material collected in reply to this circular will be published in special bulletins.

Prof. W. W. Cooke, assisted by Mr. Otto Widmann and Prof. D. E. Lantz, has prepared a report on bird migration in the Mississippi Valley. This report, which I regard as the most important contribution yet made to the subject of bird migration, will appear as a special bulletin of the division.

Mr. L. Belding, of Stockton, Cal., has prepared a report on the ornithology of the Pacific coast region of the United States, with special reference to its economic aspects. This report will be issued as soon as practicable.

EFFECTS OF MAMMALS UPON AGRICULTURE.

The influence of small mammals upon agriculture, horticulture, and forestry is a matter of great practical interest, and one upon which much has been written, particularly in Europe, where a knowledge of the subject is a qualification of admission to the government position of forester.

Our native mammals affect the interests of mankind, directly or indirectly, in a variety of ways. Some are clearly beneficial; others are so markedly injurious, that the question becomes one merely of the best means of keeping them in check; while many kinds are both beneficial and injurious, and careful study of their habits is necessary to ascertain whether the sum of their beneficial qualities exceeds the sum of the prejudicial, or the contrary.

It is impossible to estimate in dollars and cents the damage done by the commoner species, particularly by Mice and Gophers, but in the aggregate it must amount to several millions of dollars per annum. From the Atlantic to the Pacific and from the Mexican border to Canada innumerable hordes of Mice are constantly preying upon the results of man's toil. They gnaw his buildings, deplete his granaries, make their homes in his barns and hay-mows, and even infest his private dwellings to share the dainties of the pantry. In the meadow and pasture they feed upon the roots of the best grasses; in the garden, upon the roots, fruit, and seed of vegetables; and in the fields, upon grain, both standing and in the shock. In winter they

destroy fruit and forest trees and ornamental shrubs by eating the bark from the roots and trunk. The number of Meadow Mice present over a given area is subject to periodical fluctuations, and they sometimes become enormously abundant. At such times their runways through the meadows and grain fields result in the loss of at least one-fifth of the crop.

The depredations of Ground Squirrels and Gophers in the prairie regions of the Mississippi Valley and in the far West are well known, and yet the extent of the damage they do is not generally recognized. In a fertile part of the Sacramento Valley in California a few years ago the sudden increase in a species of Ground Squirrel which fed upon grain caused the land to depreciate one-half in value. To be more explicit, land which previously brought $100 per acre could not be sold for $50, and the depreciation was due solely to the abundance and ravages of the Squirrels.

Special attention has been given the animals which occasionally or habitually prey upon poultry, and the results will be made public at as early a day as practicable.

RABBITS.

The Australian Rabbit.—There has been of late a good deal of newspaper talk about the expected introduction into the United States of a large colony of so-called "Australian Rabbits," and various opinions have been expressed as to the probable effect of such an importation upon our agricultural industries. Hence a few facts concerning this Rabbit may prove of interest.

At the outset it should be stated that, correctly speaking, there is no "Australian Rabbit," no species being indigenous to Australia. The Rabbit which has done so much harm in that country and in New Zealand is an introduced species, namely, the common Rabbit of Europe (*Lepus cuniculus*).

A very good idea of the magnitude of the rabbit pest in Australia may be had from perusal of the following report of Consul-General Morgan, of Melbourne, Victoria:

> Tame Rabbits were brought to these colonies in very early years, but the common gray variety of wild rabbit, that has so overrun the country, was, so far as can be authoritatively ascertained, introduced by a large landed proprietor in the western district of Victoria about the year 1860 for the purpose of sport. From the western district they spread to the stony rises between Colac and Camperdown, in which place the splendid cover afforded them caused their rapid increase, and they multiplied with such astounding rapidity as to literally overrun all that portion of country.
>
> Some years after they were taken to other parts of the colony. The pest soon after this was found in the neighborhood of Horsham, spreading thence into the Mallee country, extending northeast to Swan Hill.
>
> The country west and north of Horsham being exceedingly favorable to them, consisting of sand hills, pine ridges, and scrub, they increased there greatly, and have done serious damage to crops during the past few years, principally since 1874.
>
> So great has been their fecundity, that there are now but few places in Victoria in which they do not exist—from Point Nepean along the coast, from Queenscliff to Geelong; in Gisborne, Ballan, Bacchus Marsh; away northwest to Nhill and north to Swan Hill; along the Murray River; on the New South Wales and the South Australian borders—Gippsland and the surrounding district being the only place in which they are conspicuous by their absence. In the rangy district of Mansfield they have made an appearance, and the Buffalo, Howqua, King, and other rivers in the neighborhood of Bright and Myrtleford, are now invaded by the pests in large numbers. It is, however, noticeable that in places where the soil is hard, or the climate cold or wet, the rabbit does not increase to anything like the extent observable in country more suited to them, such as sand hills, pine ridges, &c. There is also another peculiarity observed, which will be borne out by all who have had any great

experience on this subject, viz, that where hares increase and become numerous the rabbits do not. There may be an exception to this, such as on the Werribee estate, but nevertheless it is the rule.

LOSSES SUSTAINED.

It is doubtful whether many persons are aware of the immense loss that has been sustained in this colony through the ravages of the rabbits, but it is an undoubted fact that as much as £23,000 has been expended to clear one estate and keep the pests under, and in many others it has cost the owners large sums, from £15,000 downwards.

In addition to the expense incurred by private owners, shire councils, and the government in destroying the pests, the great depreciation in the value of land and its grazing capabilities has to be considered. For instance, the stony rises, consisting of about 20,000 acres and surrounded by some of the finest grass-land in Victoria, have been rendered of little value except for rabbits, the owners of the land obtaining a small rental from trappers; and about 4,000 acres were some while back disposed of at the low figure of 10 shillings per acre. In the discussions in the colonial parliament on the introduction of the late "Malle pastoral leases act," it was clearly pointed out that the country (12,000,000 acres) affected by the bill had been rendered almost useless and uninhabitable through the damage caused by the ruthless invader. Stations on which smiling homesteads, fine orchards, and other improvements had a few years back existed were fallen into ruin and deserted by all living creatures except the rabbits. Here, where the grass and salt-bush in 1875 were sufficient for nearly 700,000 sheep, enough did not grow in 1882 for one-seventh of that number, the loss during the past five years being estimated as at least three-quarters of a million sterling, besides £40,000 decrease to government in rents and £20,000 expended in destroying the pests. To illustrate the damage here, I cannot do better than attach the particulars given of a few stations in the above discussion.

Year 1877, Bruin Station carried 36,000 sheep, rental £500; in 1879, 10,000; run abandoned; relet under grazing license for £56. Wanga and Nipo, once carrying 20,000 sheep; rental £400; now not a sheep on the run, which was also abandoned and relet for £20. Lake Hindmarsh carried, in 1877, 33,000 sheep; lost 25,000 in two years; rent £700, now £72. Corong, 1877, 36,000 sheep, now 3,000; rent £1,050, now £150; and several others were mentioned as being in an equally bad position.

In the years 1875 and 1876 the production of wool in the Mallee country was about 5,000 bales, value £100,000. In 1882 this had fallen to 900 bales, worth, say, £18,000. Eighteen runs in this district in the year 1878 yielded 1,700 bales; in 1882 only 332 bales. The runs were all abandoned, and the land held from government under grazing leases, at an almost nominal rent, by persons that trusted that something would be done to improve the tenure under which the land could be held, and give them an opportunity and sufficient inducement to endeavor by combined action to destroy the rabbit pest, and render the land once more fit for profitable occupation.

Whether the lengthened tenure now given to this part of the colony will enable the desired result to be achieved remains to be seen.

REMEDIAL MEASURES.

During the past three years the government has expended about £30,000 in Victoria on the extirpation of the rabbit, the principal means used being poison, such as phosphorized oats and wheat, arsenic mixed with bran and chaff, and bisulphide of carbon.

The various shire councils in the badly infested districts have also adopted similar means, though in the majority of cases the rabbit act has not been strictly enforced, many of the shires not being in a position to incur the extra expense necessary to do so.

In addition to the means above mentioned, the councils have arranged for the purchase of rabbit-skins or ears and scalps, and have been assisted by the government to the extent of a bonus of 3*d*. per dozen on all skins or ears and scalps purchased by them. From various reports published at various times in the papers, and inquiries made, the number of rabbits destroyed has been considerable, at least 157,000 dozen, equal to 1,884,000 scalps and ears and skins, being paid for in less than two years; the St. Armand and Swan Hill shires being the largest purchasers.

In the Colac and Camperdown district a preserving factory was started some few years back, and operations carried on with vigor, the factory working each year for about six months, from March to October, and during that period purchasing from 750,000 to 1,000,000 rabbits, the price paid being about 2*s*. 6*d*. per dozen. These rabbits are nearly all obtained from the stony rises and surrounding districts, as they cannot be sent to the factory in proper condition from any great distance.

The sum voted this year by parliament for rabbit extirpation is £10,000, and I learn from the Sydney papers that in New South Wales no less than £74,000 has been voted for the same work and in South Australia the amount is £30,000; so that it will be seen that Victoria is by no means the greatest sufferer, more especially as she is at the expense of labor and material on crown lands in pastoral occupation as well as crown lands unoccupied.

The number of skins exported from Victoria during 1883, as near as can be ascertained, was 4,000,000, and the area of land more or less infested is about 20,000,000 acres.

Having given the above sketch anent the introduction, spread of, and damage done by the rabbits, I will now give a few particulars respecting their fecundity and the methods and means employed to destroy them.

In places where the pest is numerous they can be considerably reduced by trapping, hunting with dogs, and shooting; but these methods are expensive, slow, and will never more than thin them out, leaving plenty to multiply again. It can be asserted on good grounds that one pair of rabbits will, under most favorable circumstances, increase in two and a half years to the enormous number of 2,000,000; this is assuming the district suits them. But, allowing that they only increase to one-fourth that number, it may be easily seen how necessary it is to be continually on the watch to destroy them.

Phosphorized oats are much superior to trapping in results, and less expensive; but unfortunately experience proves that they will not always eat this grain, and when grass is at all plentiful the rabbit deems it a much greater delicacy. Singular to say, phosphorized oats are not found effective in all parts, instances being well known in which that poison has been greedily devoured in one district, whilst at the same time in an adjoining one nothing would induce the pests to touch it—bran, chaff, and arsenic being preferred. Neither of the latter mixtures can, however, be used with any effect in wet or damp weather.

Arsenic and carrots, or phosphorized wheat, have also been found effective when the other poisons mentioned fail.

I am informed by the Hon. A. Morrach, secretary for lands, that there are about 500 miles of rabbit-proof wire-net fencing erected in this colony of Victoria, at an average cost of £80 per mile.

The estimated damage by rabbits would be difficult to ascertain, but it may be safely stated that during the last ten years the loss caused by the pest through decrease in carrying capabilities of land, destruction to crops, loss of rents, &c., would amount to at least £3,000,000 sterling.

JAMES M. MORGAN,
*Consul-General.**

UNITED STATES CONSULATE-GENERAL,
Melbourne, October 5, 1886.

In New Zealand the legislature took the matter in hand in 1876 and began the enactment of a series of stringent laws for the suppression of the rabbit scourge.

Owners and occupiers of land are compelled, under a penalty, to take efficient steps to clear their property of rabbits on receiving notice to that effect from the inspector of their district; and continued neglect of such notice gives the inspector a right to take whatever steps he may deem necessary for the destruction of the rabbits, and to recover the cost summarily from the defaulting owner, in addition to the penalty. The statute, moreover, exempts from taxation all dogs certified to by an inspector as kept solely for the purpose of destroying rabbits; and imposes a penalty for the destruction or capture of ferrets, weasels, or such other animals as may be officially proclaimed to be the natural enemies of the rabbit.

In 1881 more than 500,000 acres of sheep runs were abandoned on account of the rabbits, and the loss to the exports of the colony was calculated to be $2,500,000 per annum; and it was estimated that upwards of 180,000,000 rabbits were killed in New Zealand in little over three years.

Many cases might be cited, prominent among which is that of the English Sparrow, to show that the transplanting of a naturally prolific species to a country where the conditions for its existence are

*U. S. Consular Reports for December, 1886, Vol. XX, No. 72, pp. 482–484.

favorable gives it a peculiar impetus and enables it to crowd out and supersede the indigenous related species. Hence, while there is no positive evidence to show that the European Rabbit would become the curse in this country that it is in Australia and New Zealand, yet there is no proof to the contrary, and its introduction here would be, to say the least, an unnecessary and hazardous experiment.

The Rabbits of the United States.—We certainly have enough rabbits of our own—at least a dozen native species—and the injury they inflict upon our agricultural industries is by no means insignificant. In the grape growing districts of California rabbits do so much damage by gnawing the vines that in many cases it has been found necessary to inclose the entire vineyard with rabbit-proof wire netting, the cost of which is very great.

In the San Francisco (Cal.) *Weekly Bulletin* of February 16, 1887, it is stated that for a number of years Messrs. Grimsley and Miner have been in the habit of poisoning Jack Rabbits "by thousands" on their places near Tule River, thus averting the loss of thousands of dollars. Mr. Miner estimates the number of rabbits he has killed in this way "at not less than twenty thousand, and he thinks that during this season not less than two thousand dozens have been killed by dogs and hunters along the river, many of which have been shipped to game dealers in San Francisco. From this statement, which is fully sustained by others, some idea of the magnitude of the evil can be formed. Mr. Dewey, near Tulare, has had a hunter in the early part of the season who killed usually four or five dozen a day and shipped them to the city. He says he has twenty acres of young alfalfa of last year's sowing, the growth of which the rabbits got away with almost entirely during the winter months, causing a loss during the whole season of not less than $500."

Mr. Willson G. Nowers, of Beaver City, Utah, writes to the Department, under date of February 1, 1887, as follows:

In regard to mammals, the most common, and by far the most destructive, is the hare, or, as it is usually denominated, rabbit. At times its ravages are enormous, as it sweeps down from the bench-lands and sage-plains in myriads, devouring entire fields of cereals. This was the case last year in this and adjoining counties, where its depredations amounted to several thousand dollars, and some farmers in this county lost from this source alone their entire crop of small grain. At Minersville, this county, not more than one-third of the crop was harvested. At Adamsville nearly the total crop was taken; at Greenville about one-half, and here (at Beaver) about the same proportion; and the crops in Iron County, on the south of us, were damaged to about the same extent.

Our mode of destroying these pests is to select two captains, who choose their associates from the community, and form two attacking parties, and raid the country with fire-arms, clubs, and dogs, killing every rabbit caught sight of. In some cases the slaughter has amounted to nearly one thousand by each side. These raids are made on every favorable opportunity, after a snow-storm, if possible, or monthly if no snow falls.

About nine years ago the country was overrun by these rabbits, but after two or three seasons' ravages they became so scarce that hardly a representative was to be seen. They were infested with large grubs in the head, resembling those sometimes found in the backs of cattle. These grubs invariably put an end to their victims. If this enemy had not attacked the rabbits it is probable that the latter would have produced a dearth in the land.

E. C. S. Foster, M. D., of Russell, Kansas, writes:

Rabbits are very destructive to fruit trees; they eat off the bark during the winter months, The damage done is serious.

Mr. W. Head, of Bristow, Iowa, writes:

Rabbits are injurious to fruit trees. During the winter they gnaw the bark, very often completely girdling an apple tree, which of course kills it. I consider the loss serious, as I have seen a great many apple trees killed in this way.

Mr. William J. Howerton, of Florence, Ariz., writes:

The little cotton-tail rabbit of this country occasions some damage by barking the young growth, but the damage is of comparatively little consequence and is chiefly done in the winter months.

Mr. John S. Harris, of La Crescent, Minn., writes:

Hares often do serious damage to trees and shrubs. Some seasons acres of young forest trees are barked by them. Maple and apple trees suffer most from their depredations.

Mr. J. W. Johnson, of Meriwether, S. C., writes:

Gardens are sometimes injured to a great extent by rabbits. They are particularly fond of young cabbage, collard, and pea-plants; they also gnaw the stalks of cabbage and collards in the winter. They are more injurious if the winter is severe than when the weather is mild. They are very injurious to fruit trees in the winter; they gnaw the bark from the ground up, as far as they can reach. Unless the trees are protected they will often ruin a whole orchard of apple trees.

Mr. J. C. Linville, secretary of the Agricultural and Horticultural Society of Gap, Pa., writes:

Rabbits are very destructive during deep snows. They gnaw off the bark above the snow line, and cut off small trees as thick as a lead pencil. They seldom girdle peach or cherry trees, unless apple trees are not at hand. The loss is very great.

Mr. Thomas Mikesell, of Wauseon, Ohio, writes:

Rabbits peel small apple trees and also eat off the twigs. They peel other trees and shrubs, the elder in particular. The damage is sometimes very serious.

Mrs. A. L. Peabody, of Denver, Colo., writes:

In the vicinity of Grand Junction the rabbits have injured young fruit trees to quite an extent. It was done during the winter.

Mr. F. M. Powers, of Angola, Ind., writes:

Rabbits are destructive to vines and to small fruits, such as raspberries. They injure young fruit trees by girdling and eating the bark.

Mr. William H. Madison, of East Enterprise, Ind., writes:

Rabbits destroy many young trees, especially apple trees, by gnawing the bark and thus girdling them. This is done in the winter when snow is on the ground. They do some damage to corn in the field, but not to a serious extent.

Mr. E. L. Reynolds, of Westville, Ind., writes:

The gray rabbits make their home along the hedges, in thickets, and in the timber; they increase rapidly and are the pests of young fruit trees. They are very plentiful in this part of the State, but their numbers are kept within bounds by the hunters.

Mr. N. W. Wright, of Farmland, Ind., writes:

Rabbits gnaw the bark from apple and pear trees in the fall and winter. The damage has been serious in many instances.

Mr. E. S. Beach, of Valparaiso, Ind., writes:

Rabbits injure trees in the winter, when there is a heavy fall of snow on the ground; loss sometimes quite serious.

Mr. J. C. Donaldson, of Gilbertsville, N. Y., writes:

Rabbits are injurious to grain crops, both by consuming the grain and by trampling it down.

Mr. F. Eveland, of Ferry, Iowa, writes:

Rabbits are injurious to trees. They are most destructive in winter.

Mr. George R. Prescott, of Galt, Canada, writes:

Rabbits do some injury to vegetables, but not to a serious extent.

Mr. R. Elliott, of Plover Mills, Canada, writes:

Rabbits eat herbage, chiefly clover. They girdle and bark all sorts of young trees during the winter.

Mr. L. W. Suilot, of Salem, Ohio, writes:

Rabbits eat apples and the leaves of the Swedish turnips; loss trifling.

Mr. I. H. Shank, of Hickory, W. Va., writes:

Rabbits sometimes eat fallen apples, but the loss is trifling. They gnaw the trunks of young apple trees, thus killing quite a number.

Mr. William West, of Chehalis, Wash. Ter., writes:

Rabbits occasionally injure apple trees by eating the bark during the winter, but the loss is trifling.

Mr. J. C. Cavener, of Gainesville, Tex., writes:

Rabbits are very destructive to English peas; they like cabbage also. They are liable to damage nearly all kinds of fruit trees, and all soft-rooted forest and shade trees, by gnawing their roots in two. They girdle or gnaw the bark from the collar of young peach, apple, pear, and plum; and sometimes Bois d'arc hedges are damaged by them. They are worse when the ground is frozen or covered with snow.

Mr. H. W. Buckman, of Glenwood, Cal., writes:

Rabbits eat squashes, melons, and cucumbers, both the young plant and the fruit.

Mr. David H. Herman, of Willows, Dak., writes:

Hares and rabbits gnaw young fruit trees in winter.

Mr. W. R. McDaniel, of Faceville, Ga., writes:

Rabbits eat garden peas. The loss is serious.

THE IMPORTATION OF EXOTIC SPECIES SHOULD BE GOVERNED BY LAW.

The great calamity that has befallen our agricultural industries in the importation of the English Sparrow, and the threatened danger from the introduction of the European Rabbit, should serve as timely warnings to an intelligent people and lead to legislation restricting the importation of foreign birds and mammals.

It seems desirable that a law be enacted conferring upon the Commissioner of Agriculture the power of granting or withholding permits for the importation of birds and mammals, except in the case of domesticated species, certain song and cage birds (to be specifically enumerated), and species intended for exhibition in zoological gardens, menageries, and museums, which may be brought in without special permits.

The question of the desirability of importing species of known beneficial qualities in other lands is one which sooner or later must force itself upon our notice; and it is highly important that when such experiments are made they should be conducted by or under the control of the Department of Agriculture. And it may be suggested that isolated areas, such as islands of suitable size and character, be selected for this purpose, so that the spread of the species may be prevented if the result renders this course desirable.

WASHINGTON, D. C., *February* 20, 1886.

C. HART MERRIAM,
Chief of Division of Ornithology and Mammalogy.

Hon. NORMAN J. COLMAN,
Commissioner.